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AUTOMOTIVE INDUSTRIES

NOVEMBER 1989

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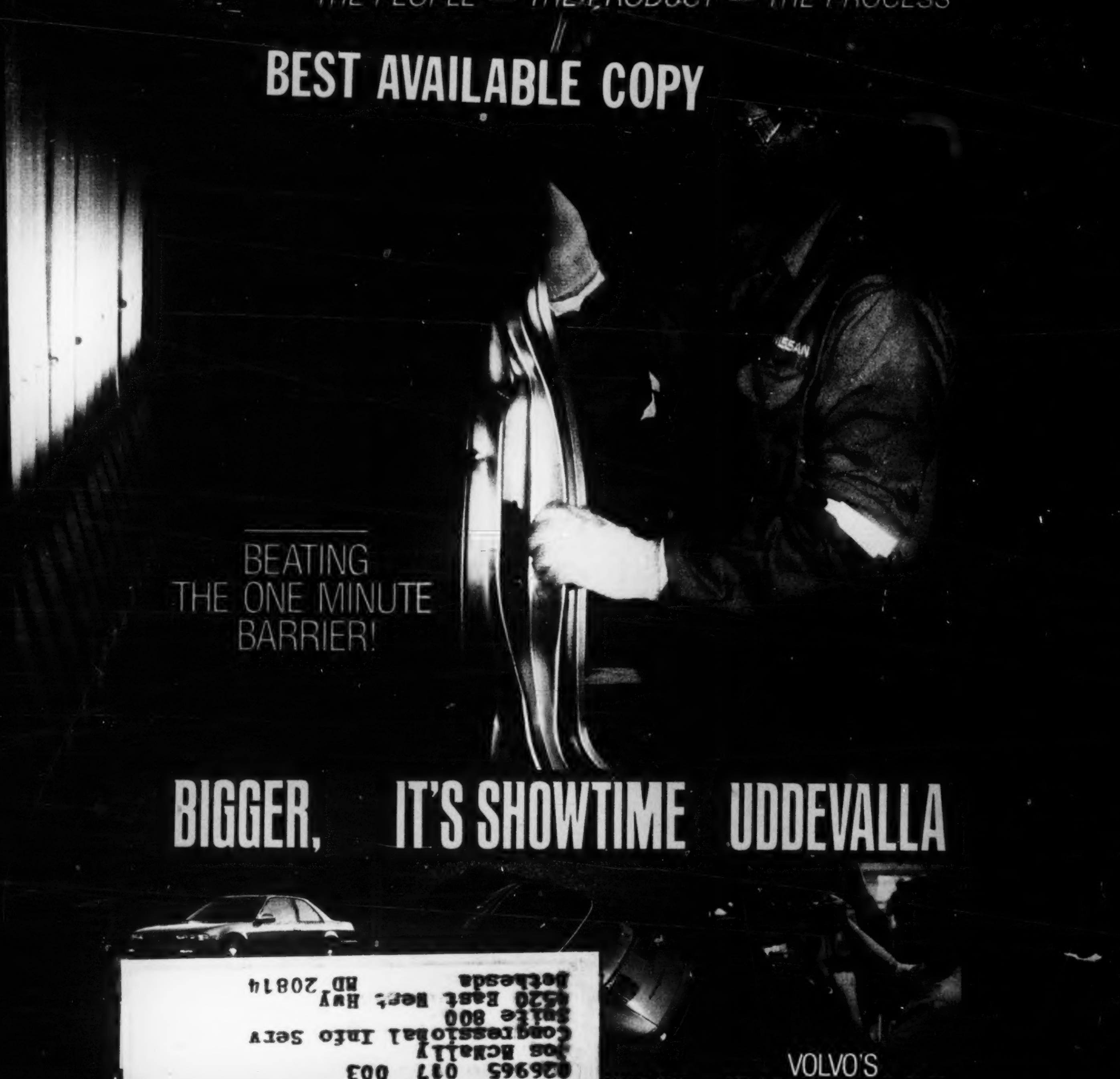

BEATING THE ONE MINUTE BARRIER!

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IT'S SHOWTIME HIGHLIGHTS OF FRANKFURT

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NOVEMBER 1989 VOLUME 169, No.11

CHILTON'S
AUTOMOTIVE INDUSTRIES
SINCE 1896

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The best stamping teams in America again face the trusty AI stopwatch in our annual Die Change Challenge. Now in its fourth season, the Challenge keeps attracting a record number of entries, while it continues to help improve the industry. Shown above is the QDC team from B-O-C Lansing South. Story on p.26.

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DIE CHANGE 1989

by JOHN McELROY

Every year our Die Change Challenge has grown by leaps and bounds, and this year is no exception: 14 different plants entered a total of 21 teams. They came from all over the US, Mexico and Canada.

More importantly, the competition hit a new level of intensity. For the first time (perhaps in the history of the industry) one of the teams broke through the one minute barrier! Just as impressively, we've also seen one-year productivity improvements that range from 15% to 60%!

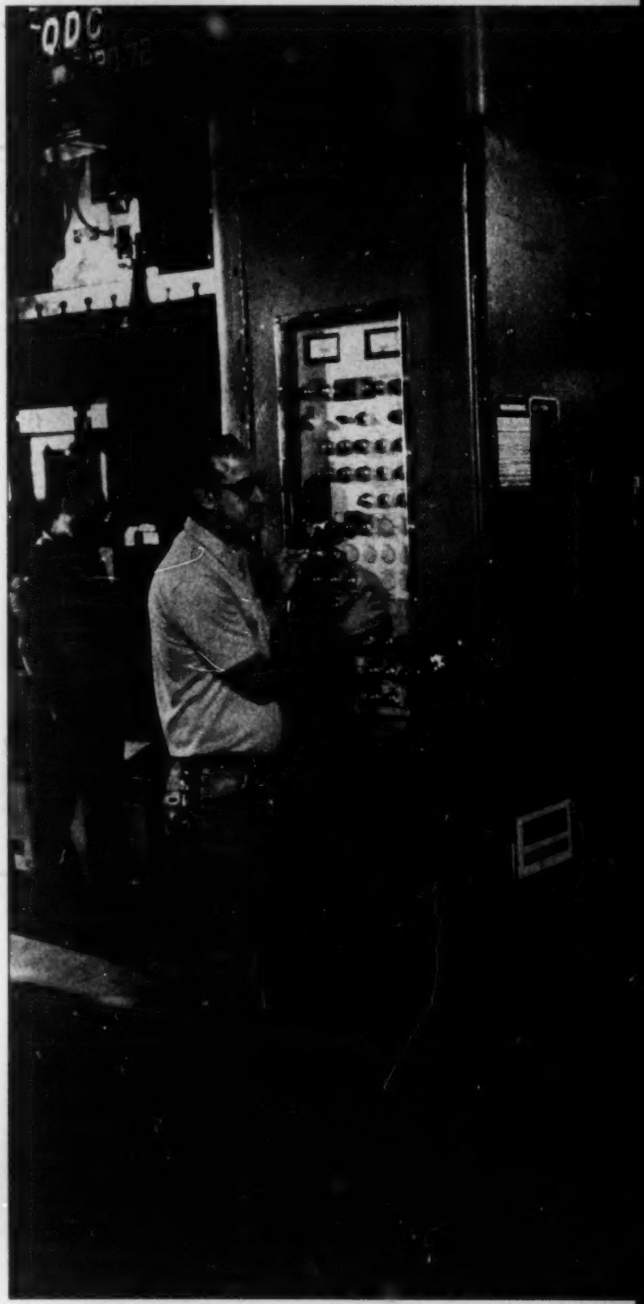
But so much for the overview. Let's get to the specifics. And just so you know we're not favoring one plant over another, we'll present each team in the chronological order in which they participated.

Ford: Hermosillo, Mexico

When most Americans think about Mexico, they either conjure up images of illegal immigrants wading across the Rio Grande, or beautiful seaside resorts such as Cancun or Puerto Vallarta. But anyone visiting Ford's Hermosillo plant will come away with a totally new appreciation of what Mexico is capable of doing.

In every sense of the word, Hermosillo is a world-class facility. Ford's internal audits and the J.D. Power CSI index show that the Mercury Tracer, which is made here, has the second-best quality in its class, and is ninth best compared to all cars sold in the US. It's easy to see why.

The people who work here are well educated, highly trained, and intensely competitive. They rely heavily on statistical procedures to improve the manufacturing process. And every improvement, no matter how small, is considered important – they showed us one improvement that reduced the



Talk about continuous improvement! GM's Indy Truck & Bus stamping turn

You want competition?
This year's Challenge involved 14 plants and 21 teams.
You want continuous improvement?
We saw productivity gains up to 60%.
You want speed?
How does a 54-second die change sound?

in a flawless 6:48 time on the automated line, down from 30:40 last year.

die change time by only 0.15 minutes!

But accuracy counts, too. To eliminate mistakes during a die change, a template is placed over the control panel which covers up all but the switches needed for this particular die change. The template also has the proper readout written on it that every gauge should be showing. Now it's impossible to flick the wrong switch or make the wrong setting.

As a result, both teams from the Hermosillo plant turned in very competitive times: 4:04, and 4:44, respectively. To that we say: "*Saludos a todos*!"

Diamond-Star: Bloomington-Normal, Illinois

The Chrysler/Mitsubishi joint venture at Diamond-Star is not only a new entry to the Die Change Challenge, it's also the newest automotive plant in North America. Moreover, the press shop may be the most automated in the world. Coils are unrolled and automatically blanked. The blanks move to their storage area on AGVs, and in turn move from storage to the press line by AGVs. There they are automatically loaded into the press line where they come out the other end as body panels.

Some panels are automatically racked – they're literally untouched by human hands until final assembly. The racks are moved to another storage area by AGVs, and are computer sequenced to the body shop. Even with these large storage areas there is only a two-day inventory of panels. The goal is an eight-hour supply – very impressive.

All the presses at Diamond-Star are transfer lines and they're all made by Komatsu. The reasoning behind this is to keep a minimum of inventory to eliminate waste.

"If you don't need it, don't buy it. If you need it, buy the best there is," explains Roy Ames, D-S's branch manager of stamping.

The two-man team managed to turn in a time of 3:18, an incredible performance for an operation that's only been open for one year. And even more impressive when you consider that John McKenzie and Mike Rust, the two associates working on this line, had no prior stamping experience. Before coming to D-S John was a coal miner, Mike a farmer.

B-O-C South: Lansing, Michigan

Every time we visit B-O-C's Lansing Fab plant it looks a little brighter, a little cleaner and more organized.

"Those are the obvious improvements," says plant manager Mike Camp. "What may *not* be as obvious, but is more important, is how management and the union work together."

This year Lansing chose a seven-press line that changed from right-hand quarter panels to left-hand quarters. Anyone familiar with stamping operations knows quarter panels are the most difficult exterior panels to stamp on a car.

In addition, the dies on this line have to be moved by overhead crane. And the clamps must be manually bolted and unbolted.

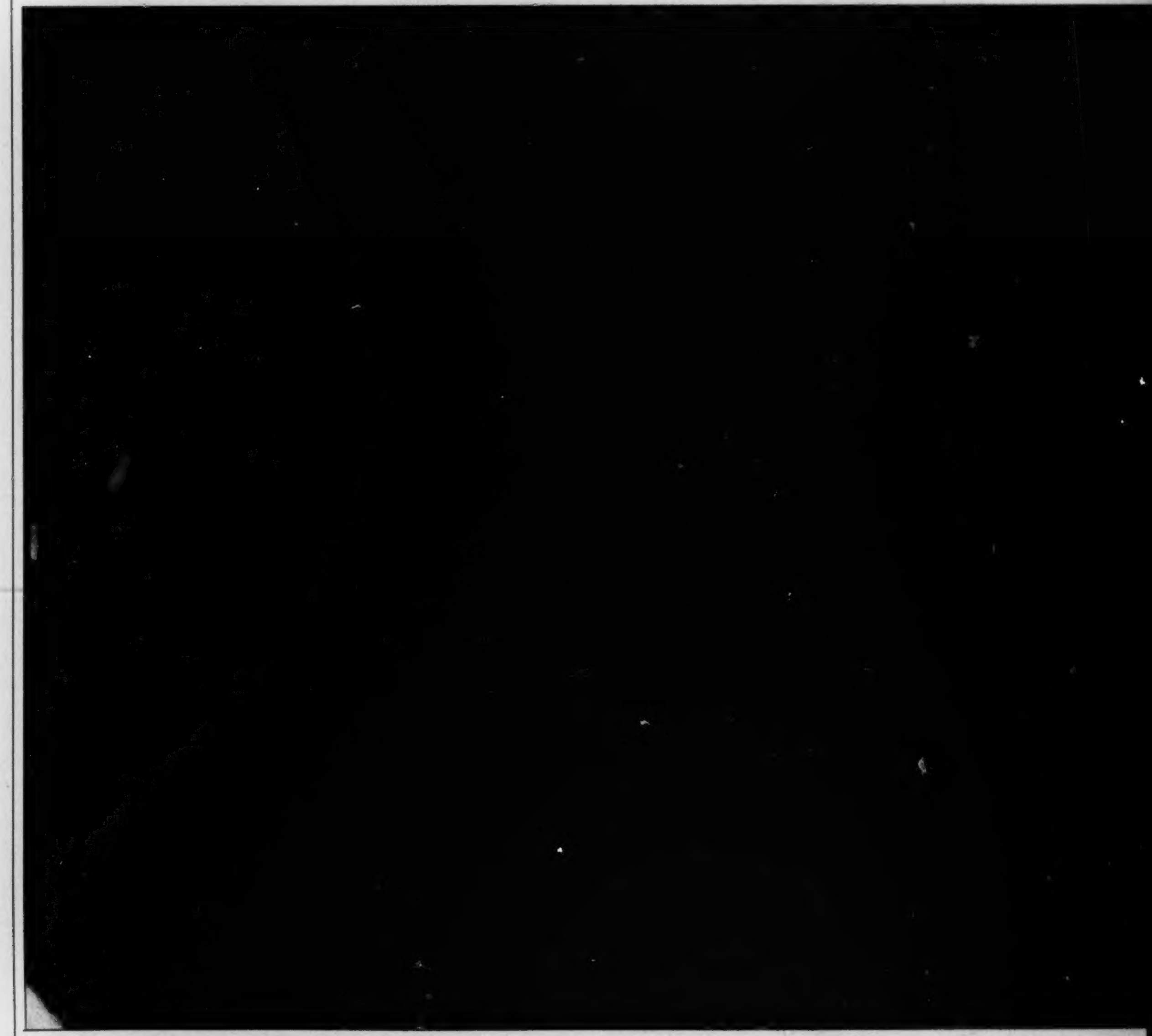
Most plants wouldn't enter the Die Change Challenge if they didn't think they could win. But Lansing Fab uses the competition to develop team work, to improve its operations, and to use that new-found efficiency to in-source work. By any definition, that's winning.

Because of its die change improvements, Lansing Fab now uses a minimum of inventory between it and the Lansing Assembly plant located a mile down the road.

"We'd better get this die change going," says Jim Armstrong, glancing at his watch. "The body shop will run out of panels at 11:30 a.m."

Talk about just-in-time – it's now a quarter to 10!

As the die change gets underway, it's



obvious everyone is making sure everything gets done right the first time. They move carefully and deliberately. After all, one mistake and you've lost more time than you would have gained by hurrying.

As the team completes its work, the stopwatch clicks off at 27:50. That's 13.5% better than last time: a solid improvement, and one achieved through teamwork.

"I read where Maryann Keller's book (*Rude Awakening*) tells how GM spends too much on technology," notes Roger Johnson, the shop committeeman.

"Well here you're seeing 10 cent solutions to million dollar problems," he says.

B-O-C Reatta: Lansing, Michigan

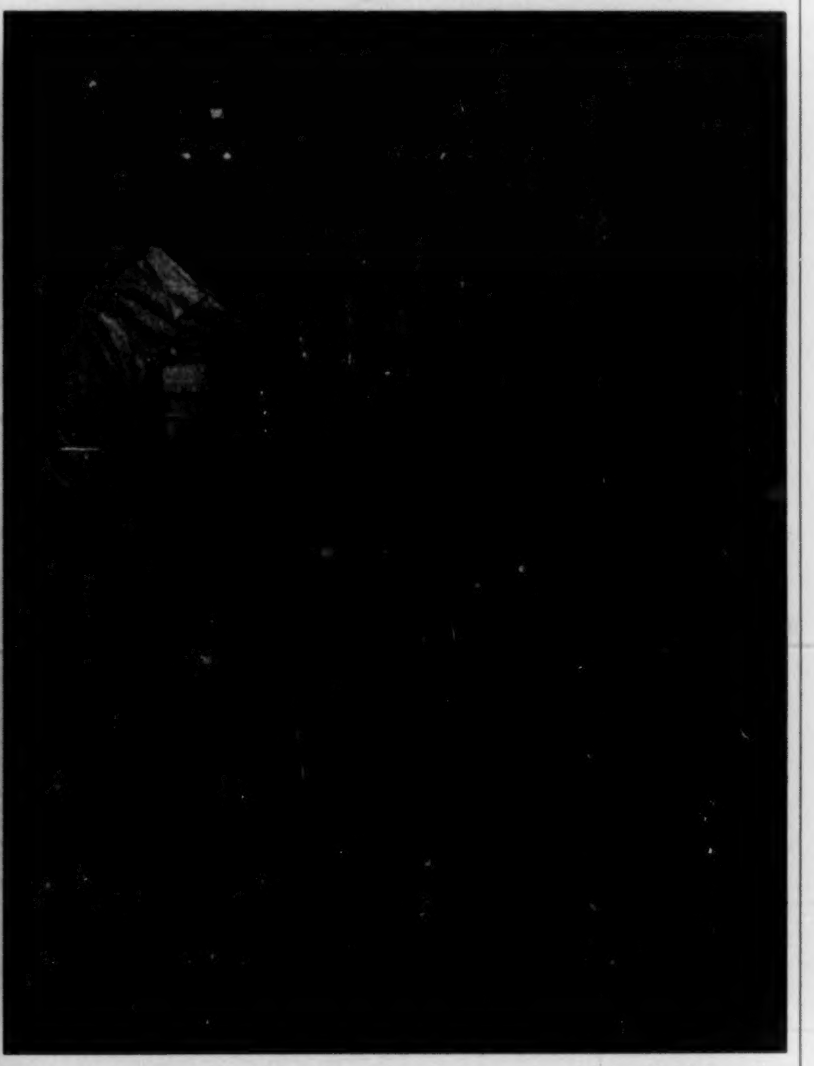
Anyone who thinks the UAW is an impediment to productivity should take a trip to the Reatta plant. The joint process at this place proves the union really can 'come to the party.' In fact, it has earned Reatta second place in our "Most Improved" category, with a 59.2% gain.

Consider this story. Last year the Reatta die change team needed two people to move a conveyor located at the end of the line. But by welding a towbar onto the conveyor, it's now automatically pushed out of the way as the die cart moves into place.

Conversely, as the die cart moves out, it pulls the conveyor back into place. Bloody simple, to be sure. But as a result, they don't need those two people anymore. In fact, these union people brag about how they eliminated those jobs. (No one was thrown out on the street; they were just assigned other work to do.)

And the improvements didn't stop there. Last year the start of the die change was signalled by a blinking red light at the head of the line. But that meant the team had to stand out in the aisle to watch for the light to start blinking. Then they would walk over to the presses to start working, which wasted precious time.

So the team installed a siren. Now they can stand right where they have to be, and start working the instant



Feeding the automated Hitachi monster at Marysville is a one-man job, but Honda's real improvement came on their tandem Danly line.

the siren sounds. To improve communication even more, the team members decided to wear wireless headsets. No more shouting or hand waving anymore. Now everyone can talk to each other in a normal voice. (When was the last time you were in a stamping plant where you could *talk* in a *normal* voice?)

Put together, all these improvements eliminated yet another job. And by allowing skilled tradesmen and production workers to work together, the Reatta team whittled this year's time down to 5:34 – a 42% improvement! "I think it's great to throw out the lines of demarcation and see you all working together to get the job done," a proud Stan Pewoski, chairman of the shop committee, tells the team. And there's no question that they got the job done fast. Just after it was done, a B-O-C executive who had driven to the plant to watch it all happen walked up to the press line. He asked when it was all going to begin, only to be told it was over.

"Already?" he asked in disbelief, turned around, got back in his car, and drove off.

"You can't be six minutes late to a five minute die change," laughs plant manager Jim Rucker.

Mazda: Flat Rock, Michigan

Mazda's transfer line placed first in our "Most Improved" category and it's worth delving into the details of how they achieved their incredible 60.2% improvement in one year.

First off, they were able to reduce three people from the die change team. This was done by carefully analyzing what everyone was doing, and by simplifying each operation. Then they applied the kaizen process to take time out of the internal die change set-up.

For example, now they stop the press on the last panel, which eliminates one press cycle, and saves 20 seconds. Last year they had to wait for the computer program to automatically bleed air pressure out of the die cushion. But now they do it manually, which eliminates a step the computer goes through and speeds up the whole program.

Another change in procedure involves the fingers on the transfer mechanism. Previously the teams stored the fingers in the aisle next to the press. Now, they store the fingers in a cage at the front of the press, which means they only have to be moved about two feet instead of 20, which saves more precious seconds. And to get the die changers in and out of the presses faster, the teams took the latches off the doors, which are now held in place by the safety plugs. That saves more time.

Then, on Mazda's tandem press, potential confusion is eliminated by painting the automation arms red and blue. The red arms go on the south (warm) side of the press, the blue arms go on the north side (cold). This saves time because now it's hard to install the wrong arm on the wrong side.

After the teams brainstormed these improvements, they'd implement them. Immediately upon trying them

TRANSFER LINES

COMPANY	TIME	# PEOPLE	LINE	PANELS	STEEL	UAW LOCAL
GM Truck	2:50	6	Schuler	C/K Cab Corner	National	23
Diamond Star	3:18	2	Komatsu	Laser Hood/Tail	Nippon	2488
Mazda	4:27	3	Komatsu	Probe Doors	Nippon	3000
Honda	5:16	1	Hitachi-Zosen	Civic Doors	Inland	--
Nissan	5:32	2	Hitachi-Zosen	Sentra Doors	Nippon	--

DIE CHANGE TIME COMPARISON

RANK	COMPANY	PLANT	PRESS TYPE	TIME
1.	Nissan	Smyrna, TN	Tandem I	0:54
2.	Nissan	Smyrna, TN	Tandem II	0:57
3.	Honda I	Marysville, OH	Tandem	2:49
4.	GM Truck	Indianapolis, IN	Transfer	2:50
5.	Diamond-Star	Bloomington, IL	Transfer	3:18
6.	GM/Cadillac	Grand Blanc, MI	Tandem	3:46
7.	Chrysler	Twinsburg, OH	Tandem	3:53
8.	Ford	Hermosillo, MX	Tandem	4:04
9.	Mazda	Flat Rock, MI	Transfer	4:27
10.	Ford	Hermosillo, MX	Tandem	4:44
11.	Honda II	Marysville, OH	Transfer	5:16
12.	Nissan	Smyrna, TN	Transfer	5:32
13.	GM Reatta	Lansing, MI	Tandem	5:34
14.	Cosma/ Karmax	Milton, CN	Tandem	6:43
15.	GM/Truck	Indianapolis, IN	Tandem	6:48
16.	Mazda	Flat Rock, MI	Tandem	6:51
17.	Chrysler	Warren, MI	Tandem	7:16
18.	GM/Buick	Flint, MI	Tandem	15:33
19.	Chrysler	Sterling Hts, MI	Tandem	24:05
20.	GM/Cadillac	Grand Blanc, MI	Tandem	24:06
21.	GM/B-O-C	Lansing, MI	Tandem	27:50

out, they'd hold a team meeting to discuss how well it worked. Then they'd hold another brainstorming session. By diligently sticking to this process, the Flat Rock teams came up with their astonishing productivity improvements.

Karmax: Milton, Canada

It's unusual to see a stamping plant in the Die Change Challenge make parts for a vehicle that's not even in production. But Karmax, a division of Cosma International, is used to doing the unusual. In fact, it's one of their selling points.

The panel that our Canadian friends decided to change during the '89 Challenge is the roof panel for Ford's UN-46, the replacement for the Bronco II, which will be re-named Explorer when it debuts next spring.

As anyone involved in stamping can appreciate, it would have been a lot easier for Karmax to change older dies that everyone was familiar with. But Karmax, which has only stamped out about 500 panels on these dies, used the Die Change Challenge to help get the UN-46 dies production-ready.

"If you are in a five-year program and you spend the first two years getting efficient, then you only get three years to work at getting profitable. You can't do that. You have to be ready and efficient from Job One," explains Dick DeMara. Even more, this was a roof panel, which also adds to the difficulty.

MAUAL PRESS LINES

COMPANY	TIME	# PEOPLE	PRESS	TYPE	# PRESSES	BOLSTERS	CLAMPS	PANELS	STEEL	UAW LOCAL
Cadillac Grnd Blanc I	3:46	21	Danly	Tandem	5	None	Manual Doors	Deville	Bethlehem	1292
Chrysler Sterling Hts.	24:05	40	Schuler	Tandem	5	Rolling	Manual	C-Y Body-sides	US Steel	1264
Cadillac Grnd Blanc II	24:06	9	Danly	Tandem	7	None	Manual	Seville Rear 1/4	Bethlehem	1292
B-O-C Lansing	27:50	12	Verson	Tandem	7	None	Manual	N-Car Rear 1/4	Inland	652

Buick City realized a 14.8% productivity gain over last year.

DIE CHANGE 1989

"We chose a roof panel because it's a big, complex panel. And we chose that because that's what we're known for," notes plant manager Ueli Spring. Yet even with these "handicaps" Karmax managed to achieve an impressive 45.6% productivity improvement over last year.

"Whew, that's very good – but nerve-racking," sighs Yvonne McLauchlan, a quality inspector, as the die change is completed.

Chrysler: Warren, Michigan

A huge crowd of spectators greeted us at Chrysler's Warren Stamping plant. And we were greeted with a display of creative ingenuity. This year the Warren plant decided to enter a press line that had never been set up for quick die change, with dies that were never designed to be changed quickly, either.

So to get themselves competitive, the team – made up completely of volunteers – went to work to convert the line for quick die changes. All the changes were done in-house.

First, they commonized everything: bucks, draws, shut heights, and pass heights. Then they took die-carts that were lying out in the yard because they were considered obsolete, and rebuilt them – even though they had approval to buy new ones. The skilled trades workers on the team found a way to make the carts move 10 times faster than their original design.

"When the people build it themselves, they know it so well that you get better results than with something you bought," explained one of the workers.

To commonize the locator points on the dies, the team installed plates (that came from a closed AMC stamping plant) on top of the die. And they put rollers under the dies in the press so they can be moved in and out more easily. Then they modified the blank feeder table so it could be easily moved by one man, instead of by four. And they re-wired the automation so it didn't have to be unplugged to be moved.

The team, with 27 people on it, is bigger than it has to be. But that's by design. They feel it is more important to get more people involved than to leave them out and do better in the

Lansing South still uses overhead cranes, but teamwork paid off: a 13.5% productivity improvement versus 1988.

Die Change Challenge.

It certainly paid off – what took eight hours to do before they made all the changes is now done in seven minutes. "What was a dream a year ago is reality today," beamed one of the team members.

Cadillac: Grand Blanc, Michigan

A visit to Cadillac Stamping is always good for the soul. You can't come out of this plant without being on an emotional high, because the teamwork and camaraderie that exists at this plant is contagious.

Not only did last year's team knock a minute off their time, they did it with one less person – good for a solid 28% improvement in productivity. This year, the plant entered a second team which worked on a totally manual line, one that requires an overhead crane to move all the dies.

You can't do that fast. Though they knew going in that it would be tough to win the Die Change Challenge, so they set out to beat their own internal goal: 48:00.

It was important for this team to hit its goal, because this line is pioneering an inventory pull system at GM called assured scheduling. The process consists of four loops: the outside suppliers, the blanking line, the stamping line and the Hamtramck assembly plant. The manufacturing schedule is set by the assembly plant, on a daily basis, and each loop only builds what the downstream operation needs.

GM claims this will help cut inventory levels in half, which will also cut costs and boost quality.

As our stopwatch clicked off in 24:00, it was impressive to see that Grand Blanc had easily beaten their internal goal. "That's just a start," says a team member. "There's always room for improvement."

GM Truck & Bus: Indianapolis, Indiana

The Truck & Bus operation in Indianapolis is impressive. It's huge: 1.3 million ft^2 under roof, and 39 press lines. They convert 2000 tons of steel into product *every day!* But just because you're big doesn't automatically make you good. And this year, Indianapolis Truck & Bus was out for blood.

Last year the team encountered an

TANDEM LINES W/DIE CARTS

COMPANY	TIME	# PEOPLE	PRESS	TYPE	# PRESSES	BOLSTERS	CLAMPS	PANELS	STEEL	UAW LOCAL
Reatta	5:38	7	Danly	Tandem	3	Die Carts	Auto	Reatta Doors	Armco	1618
Chrysler Warren	7:16	27	USI	Tandem	5	Die Carts	Manual	T-111 Doors	National	869
Buick City	15:33	18	Danly	Tandem	6	Die Carts	Manual	LeSabre Rear ¼	LTV	599

AUTOMATED TANDEM LINES

COMPANY	TIME	# PEOPLE	PRESS	TYPE	# PRESSES	BOLSTERS	CLAMPS	PANELS	STEEL	UAW LOCAL
Nissan I	0:54	8	Hitachi-Zosen	Tandem	5	Rolling	Auto	King Cab Bedside	Nippon	--
Nissan II	0:57	6	Hitachi	Tandem	5	Rolling	Auto	Sentra Fenders	Nippon	--
Honda	2:49	7	Danly	Tandem	3	Rolling	Semi-Auto	Civic Hood	Inland	--
Chrysler Twinsburg	3:53	18	Schuler	Tandem	5	Rolling	Auto	P-Car Doors	National	122
Ford Hermosillo I	4:04	7	Komatsu	Tandem	5	Rolling	Auto	Tracer Doors	Nippon	--
Ford Hermosillo II	4:44	7	Komatsu	Tandem	5	Rolling	Auto	Tracer Doors	Nippon	--
GM Truck	6:48	10	Danly	Tandem	5	Rolling	Auto	C/K Doors	Bethlehem Thyssen	23
Mazda	6:51	3	Komatsu	Tandem	5	Rolling	Auto	Probe Rear ¼	Sumitomo	3000

electrical glitch that slowed their die change to 30 minutes. So they diagnosed the cause of the problem and rewired the presses so it could never happen again.

But they weren't content just to fix the problem. They continued to improve the die change process. For example, the team reprogrammed their computers so they could use one program. That eliminated wasted time waiting for the next program to download. Then they put two motors on each bolster to speed them up.

After that, all the hydraulic connections were moved to the same side of each bolster so no one had to walk around to disconnect them. And all the electrical connectors were changed to plug in the same way. As a result, the team's die change time dropped to under 7:00!

Indianapolis also entered a new team this year, on a Schuler transfer press. As it turned out, it was the fastest transfer press operation we saw this year. But to the team members, that was not the most impressive aspect of their die change.

"The big lesson was not our time, but what we learned getting ready for the Challenge and how we can apply those lessons to other lines in the plant," explains a team member.

"A year ago we couldn't even do a quick die change. Then we got down to 30 minutes, then took that down to 15 minutes. I thought that was excellent. I laughed to myself when the team set a goal of four minutes. But look, here we did it in 2:50!"

Nissan: Smyrna, Tennessee

What's the right word to describe Nissan's die change teams? Incredible? Unbelievable? Fantastic?

Last year the Smyrna team turned in a time of 1:20, and frankly we didn't think that it would be possible to change dies any faster. But these guys set out to rewrite the book on die changes. And rewrite it they did.

Today the automotive industry's target can no longer be measured by SMED – single minute exchange of dies. Now it has to be SSED – single *second* exchange of dies.

Not only did Nissan break through the one minute barrier, the plant did it twice! The first team took 57 seconds; the second team took only :54.

Obviously, both teams were totally elated with their performance. "Want my autograph?" one the team members asked me as he strutted by.

But though they were elated, they weren't completely satisfied.

"We made two major mistakes," said one of the night shift team members. "We should have knocked off another seven seconds."

"Hey, that's OK," retorted another. "If we did everything right, it would be too hard to beat *next year*."

Honda: Marysville, Ohio

At its Marysville plant, Honda has the biggest stamping press in the world – a 4800 metric ton monster. Yet, even though this Hitachi is so massive, it is also so automated that Honda can do the die change with only one person.

The Marysville die change starts as an associate twists a knob on the control panel. Then, with a loud hiss, the battleship-sized press comes to a stop. Loud clangs emanate from deep inside the press. Long rows of clamps rotate backwards in perfect unison.

With a whoosh, the rams go up. The transfer mechanism cycles back onto the bolster, the scrap chutes drop down while the safety gates go up. And as the warning horn starts to blare, the old bolsters glide out of the press, with the new ones behind them.

Now the entire process is reversed. And as the new dies are automatically clamped up, the transfer mechanism begins to move again, surprisingly fast for such a massive piece of equipment. And as the associate walks to the end of the line, the first panel comes off in 5:16. But that's not all.

Honda also entered its tandem Danly line, the only line that has been entered in every Die Change Challenge. Talk about continuous improvement: The first year it took 5:14, the second year 4:38, last year that dropped to 3:57. And this year they shaved it down to 2:49.

In fact, the Marysville die changers got their bolsters moving so fast that they were hitting their stops so hard they ran right over them! So the team installed switches that slow the bolsters down before their stops.

Funny, that's probably the first time we've encountered a team that had to slow down a QDC in order to speed up.

Chrysler: Twinsburg, Ohio

We weren't sure what to expect at Chrysler's Twinsburg Stamping plant since this was their first year in the Die Change Challenge. The team sure didn't give us much time to watch them in operation, because 3:53 after they started, they were done!

The instant the press line came to a stop, the team launched right into their die change with choreographed precision. With a blur of movement, dies were shuttled in and out of place. And as the first panel started coming down the line, a large group of people followed it from press to press, looking for all the world like a group of nervous fathers waiting for their first-born in a delivery room.

"I tell 'ya, I'm so proud of this team I'm having a helluva time keeping my eyes dry. I love each and every one of you," the plant manager told them when it was over.

The team responded with whooping cheers and applause. And they meant it, each and every one of them.

Chrysler:
Sterling Heights, Michigan

We see an amazing variety of press lines during the Die Change Challenge, but few are as impressive as the traditional-type presses at Chrysler's Sterling Heights plant.

Whomp! Bam! Thud! Watching this line in operation, for us, is almost an intimidating experience.

But not for the die change team. They go about their business, working methodically and diligently. Any time a problem crops up no one panicks. And there are extra hands ready to pitch in to keep things moving.

As soon as a press is ready, a team member stands back and signals down the line with a 'thumbs-up.' As the first blank is fed into the first press a group of people walks down the line with it. With every stroke of each press it begins to look less like a sheet of steel and more like a body panel.

With each stroke more value is added to that panel. And when our stopwatch clicked off at 24:00, there was a lot of satisfaction with the accomplishment. It wasn't long ago that the same operation took 11 hours.

Anybody who thinks the UAW hinders efficiency hasn't been to the Reatta Craft Center. These guys improved their productivity by over 59%!

MOST IMPROVED DIE CHANGE, 1988-1989			
RANK	COMPANY	PLANT	% IMPROVEMENT
1.	Mazda	Flat Rock	60.2%
2.	GM	Reatta	59.2%
3.	Honda II	Marysville	56.8%
4.	Nissan I	Smyrna	52.5%
5.	Karmax	Milton	45.6%
6.	GM	Gr Blanc I	28.0%
7.	GM	Buick City	14.8%
8.	Honda I	Marysville	12.4%

DIE CHANGE PRODUCTIVITY COMPARISON			
RANK	COMPANY	PRESS TYPE	MAN MIN./ CHANGE
1.	Honda II	Transfer	5.2
2.	Nissan II	Tandem	5.7
3.	Diamond-Star	Transfer	6.6
4.	Nissan I	Tandem	7.2
5.	Nissan	Transfer	11.0
6.	Mazda	Transfer	13.35
7.	Gm Truck	Transfer	16.90
8.	Honda I	Tandem	19.70
9.	Mazda	Tandem	20.55
10.	Ford I	Tandem	28.40
11.	Ford II	Tandem	33.10
12.	GM-Reatta	Tandem	38.90
13.	Karmax	Tandem	47.00
14.	GM-Truck	Tandem	68.00
15.	Chrysler Twinsburg	Tandem	69.80
16.	GM-Cadillac I	Tandem	79.00
17.	Chrysler-Warren	Tandem	196.10
18.	GM-Cadillac II	Tandem	216.90
19.	GM-Buick	Tandem	279.90
20.	GM-Lansing	Tandem	333.90
21.	Chrysler-Sterling	Tandem	963.30

B-O-C Buick City: Flint, Michigan

Buick City is on a natural high that began earlier this summer. That's when J.D. Power's Initial Quality Survey rated the Buick LeSabre as the second best quality car sold in the US. That one little report created such a surge in LeSabre sales that the plant has had a hard time keeping up with demand. And that has put pressure on the die change team to consistently do quick die changes.

"The guys had to find new ways to get some more efficiency, but we've got good people here," explains one of the managers. "They found ways to speed up the die carts and they also improved the programming. But more importantly, with sales going up, morale is going up with it."

As a result of their changes, the team achieved a solid 14.8% productivity improvement in one year. But they aren't satisfied. "I know we can do better. Wait until next year," says one team member.

Final Results

The 1989 Die Change Challenge has become something of a challenge for us at *Automotive Industries*. The competition this year was more intense than we had ever seen before. And you could tell it meant that much more to every team that entered. That makes picking a winner all that more difficult. But here are our choices:

- The Most Exciting Team In Action is undoubtedly Grand Blanc's. This team's enthusiasm is so contagious it makes you want to stand up and cheer them to go faster.
- The Most Improved honors goes to Mazda's transfer line team, which achieved a one-year improvement of 60.2%. But the Reatta team also gets an Honorable Mention. Its 59.2% improvement was second to Mazda.
- The Fastest And Most Impressive Team, or in this case Teams, are Nissan's. They're phenomenal. Whenever anyone asks us how it's possible they can change dies so quickly, our response is usually something like, "You just have to see it to believe it."

But as we've said for the last four years, we're not just looking for the fastest teams. We're looking for the best. And this year the Most Efficient Die Change honor goes to Honda's one-man die change team on Marysville's transfer press. AI

AUTOMAKER QUARTERLY REPORT

by Dr. THOMAS O'GRADY

After an industry-wide sales slump during the first half of the year, third quarter 1989 passenger car volume rose 2.8% over total third quarter '88 volume.

Heavier incentive programs from both domestic and foreign automakers this year, consumer anticipation of impending price hikes, and new 1990 models, particularly those in the sporty segment, trickling onto the market helped to boost overall sales.

Ford led the industry in increased passenger car market share for the third quarter, followed by gains at Toyota and GM. But total American share of the market continued to drop as Big Three automakers increased their sales of transplant vehicles built by Japanese companies.

Total transplants captured an 11.4% share of the US passenger car market in third quarter '89, up from a 9.0% share in the year ago period. Five of the 13 transplant models currently wear domestic nameplates.

> *Total American share of the market continues to drop, as the Big Three increase their sales of transplant vehicles.*

Toyota posted a strong 9.4% rise in volume for the quarter, aided by increased domestic capacity at its Georgetown, KY and Cambridge, Ontario plants this year, as well as the strong initial launch of Lexus cars.

GM improved its third quarter sales performance this year, not only with incentive programs, but also through several better positioned products, particularly from Chevrolet/Geo, Buick and Cadillac.

Meanwhile, market shares for Isuzu, Mazda, Hyundai, Subaru and Volkswagen are still dropping rapidly. Mazda and Subaru, however, have new 1990 models that could be strong enough to turn sales around.

The publishing division of Integrated Automotive Resources, Inc., is pleased to introduce its industry newsletter, *Fast Track News*. Available in Sales and Production editions, *Fast Track News* contains automotive data not available in any other publication. Sales and Production Editions (60 issues), $399; Sales Edition (36 issues), $295; Production Edition (24 issues), $195. Call IAR at (215) 687-1559.

Dr. Thomas O'Grady is president and chief analyst of Integrated Automotive Resources, Inc. in Wayne, PA.

WHAT'S HOT!
Domestic Auto Sales 3rd Quarter 1989

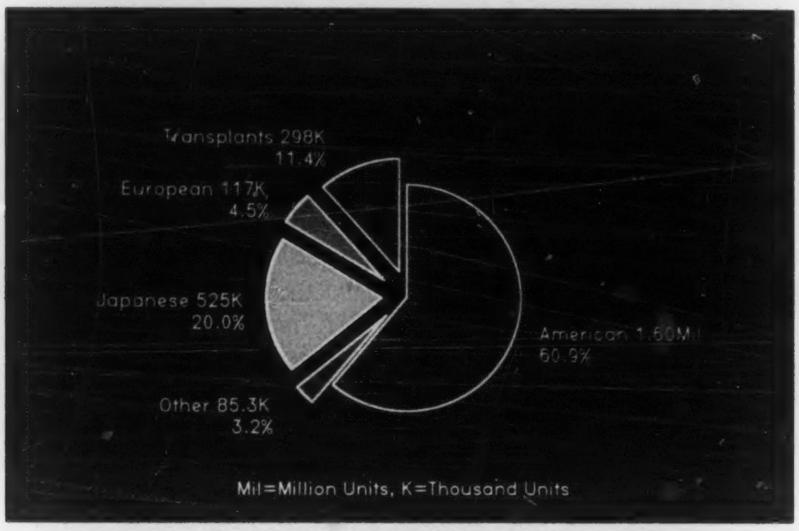
Carline	'89	'88	% Change
Escort	98,767	102,539	-3.68%
Accord	96,907	90,849	6.67%
Taurus	87,087	75,944	14.67%
Corsica/ Beretta	80,572	84,913	-5.11%
Cavalier	76,010	73,560	3.33%
Camry*	73,957	69,906	23.60%
Civic*	68,019	42,798	58.93%
Tempo	59,651	74,838	-20.29%
Celebrity	55,192	67,216	-17.89%
Sentra*	53,599	66,789	-19.75%

* – Includes imports

US Passenger Car Market Shares 3rd Quarter, 1989

Manufacturer	'89 Sales	% Total	'88 Sales	% Total	% Change
General Motors	928,037	35.33%	892,133	34.91%	4.02%
Ford	586,327	22.32%	547,891	21.44%	7.02%
Chrysler	263,127	10.02%	275,124	10.77%	-4.36%
Honda/Acura	209,518	7.98%	196,596	7.69%	6.57%
Toyota/Lexus	190,001	7.23%	173,660	6.80%	9.41%
Nissan	136,174	5.18%	128,580	5.03%	5.91%
Mazda	63,116	2.40%	67,298	2.63%	-6.21%
Hyundai	47,752	1.82%	60,473	2.37%	-21.04%
Subaru	37,451	1.43%	40,695	1.69%	-16.77%
VW/Audi	36,786	1.40%	44,200	1.73%	-7.97%
TOTAL CARS	2,626,787	100%	2,555,655	100%	2.78%

(Continued p.74)



Passenger Car Market Share By Geographic Base

Third Quarter 1989

Manufacturers	Total Sales	Total Market Share
American	1,600,493	60.93%
Japanese	525,354	20.00%
European	117,632	4.48%
Transplants	298,023	11.35%
Other Imports	85,285	3.24%
Total	**2,626,787**	**100.00%**

3RD QUARTER 1989 DOMESTIC LIGHT TRUCK PRODUCTION*

COMPANY	FULL-SIZE TRUCKS	COMPACT TRUCKS	FULL-SIZE VANS	COMPACT VANS	FULL-SIZE SPORTS UTILITY	COMPACT SPORTS UTILITY	TOTAL 3Q '89	TOTAL 3Q '88
CHEVROLET	137,176[1]	51,919	32,211	42,859	30,095	42,208	336,468	355,737
FORD	132,413	53,508	40,212	42,382	12,967	19,170	300,652	332,054
GMC	46,738[1]	14,589	12,080	10,660	10,980	12,630	107,677	106,150
CHRYSLER	19,116	19,155	19,498	97,478	—	—	155,247	125,401
JEEP	—	5,117	—	—	1,823	63,941	70,881	67,425
NISSAN	—	25,965	—	—	—	—	25,965	14,989
PONTIAC	1,366	—	—	—	—	—	1,366	—
OLDS	737	—	—	—	—	—	737	—

[1] Includes Suburban and P-model. *Built in the US and Canada.

AUTOMOTIVE INDUSTRIES

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SUPPLIER STRATEGY '90

SUCCEEDING WITHOUT COMPETING

DECEMBER 1989 VOLUME 169, No. 12

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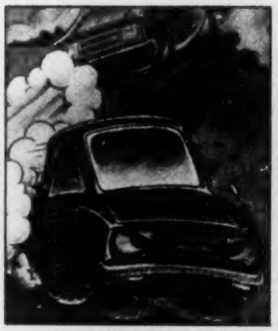

Want to succeed in business and avoid competition at the same time? Read our cover feature, beginning on page 33, to find out how.

Cover art by Tom Barrett

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TOP SUPPLIERS 1989

Automotive Industries' exclusive alphabetical listing
of the industry's top OEMs.

COMPANY	1986 SALES*/PROFIT	1987 SALES*/PROFIT	1988 SALES*/PROFIT
Acme-Cleveland	186/(1.8)	176/11.3	176/(29.4)
Alcoa	6,505/254	7,838/200	9,795/861
Allied-Signal	9,888/605	11,116/656	11,909/463
AMP	1,933/164	2,317/250	2669.7/319
A.O. Smith	911/26	970/15.4	1,063/19
Armco	2,640/(362)	2,927/118	3,227/145
Arvin Industries	995/41.2	1,373/47.6	1,365/3.5
Ashland Oil	6,991/208.6	6,993/161	7,753/224
Atlantic-Richfield	15,800/615	17.600/1.224	17,626/1583
Banner	NA	NA	547.6/(7)
Ball Corp.	1,070/58.9	1,054/66	1,073/50
BASF	3,645/104.6	NA	5,000/149
Bayer USA	NA	NA	4718.5/124.4
Bethlehem Steel	4,333/(152.7)	4,620/174	5,488.8/403
Borg-Warner	3,623/206.3	3,500/NA	3.2177/419
Bridgestone	NA	NA	9,454/317
Briggs & Stratton	745/34.1	785/26.6	914/30
Brown & Sharpe	137/(1.2)	152/(1.1)	180/3.3
Carpenter Technology	517/7.7	480/4.5	555.5/24.3
Caterpillar	7,321/76	8,180/350	10,435/616
Champion Spark Plug	883.8/1.0	720/24.4	784.6/23.6
Cherry Corporation	160.6/2.7	194.6/7.4	213.6/4.4
Cincinnati Milacron	849/23.3	827/(79.9)	857.8/37
Clark Equipment	954/(60.6)	1,048/(16.6)	1,278.3/46
Colt Industries	1,616/89.3	1,642/75.0	1,656/91
Cross & Trecker	399/ 189	422/(24.4)	456.7/(46.5)
Cummins Engine	2,303/(107)	2,767/13.8	3,310/(63)
Cyclops Corp.	NA	NA	1,250.8/28.6
Dana Corp.	3,695/117	4,142/132.9	5,171/162
Deere & Co.	3.516/(229.3)	4,134/(99.0)	5364.8/315.5
Dow Chemical	11,113/732	13,377/1,240	16,682/2,398
Dow Corning	1,085/110.6	1,303/135	1,476.8/150.5
Dresser Industries	3,661/9.6	3,120/49	3,941.7/156.8
DuPont	27,148/1,538	30,468/1,786	32,514/2,190
Eagle Picher	648/38.8	677/39.9	770/13.7
Eaton	2,760/138	3,138/201	4,237/212.3
Emhart	2,094/(10.2)	2,454/106	2,762.5/126.6
Englehard	2,289/53.3	NA	2,350.7/63.7
Federal Mogul	941/29.1	1,075/36.5	1,176.9/41.7
FMC Corp.	3,003/152.5	3,139/191	3,286/129.2
GenCorp.	1,537/130	1,619/475	2,049/70
General Electric	35,211/2,492	40,515/2,915	49,414/3,386
General Instrument	794/(46.8)	788/(80.3)	1,315.5/66.2
Gleason Corp.	252/1.6	229/(1.3)	210.7/(4.2)
Goodyear	10,328/124	9,905/771	10,810.4/350
Harvard Industries	314/12	559/17	680/14
Hercules	2,615/227	2,693/821	2,802/120
Hoechst Celanese	2,891/213	4,596/169	5,679/250
Inland[1]	3,173/19.3	3,453/145	4,068/262
Intermet	295/19	317/21.4	357.8/16.2
ITT	17,437/494	19,525/1,018	41,941/19,355
J.P. Industries	234/10.8	386/14.8	547.4/14.8

See page 79 for notes.

TOP SUPPLIERS 1989

COMPANY	1986 SALES*/PROFIT	1987 SALES*/PROFIT	1988 SALES*/PROFIT
Litton	4,521/71	4,419/138	4,863.9/167
Loctite	266.8/23.2	337.8/30.7	416/41
LTV	7,271/(3,251)	NA	7,525.7/(3,153.6)
Lubrizol	985.2/78.2	1,022/81.3	1,117.5/140
Magna International	1,027/47	1,152/40	1,459/19.5
Masco Industries	712/9.4	2,233/218	1,651.1/82.1
Maxxum	NA	NA	519/17.5
Michelin	NA	NA	8,700‡/NA
Modine	349/19.7	395/25	423.8/26.2
Monsanto	6,879/433	7,639/436	8,293/591
Morton Thiokol	1,950/133	1,987/138	2,316.4/145.3
National Steel	2,128/(59.8)	2,416/47.8	2,599/88.2
Navistar	3,357/2	3,530/33	4,080/244
Norton	1,107/(33)	1,260/66.5	1,410/95.6
Owens-Corning	3,644/15.6	2,891/200	2,831/189
Phillips Pet.	9,770/228	10,721/35	11,304/650
PPG	4,687/316	5,183/377	5,616.7/467.6
PRAB	22/(.784)	19.5/(1.1)	24.6/0.529
Prime Computer	NA	NA	1,594.6/19
Quaker State	899/50	NA	869/14.9
Quanex	325/(19.9)	345/5.2	462.9/18.4

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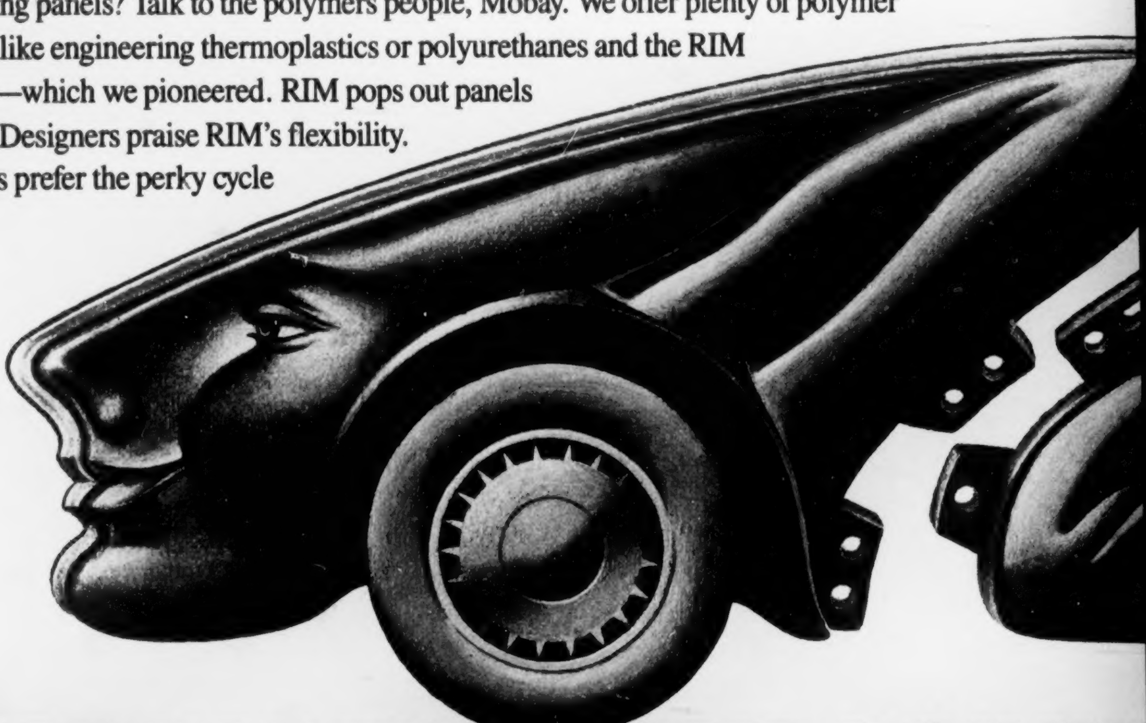

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COMPANY	1986 SALES*/PROFIT	1987 SALES*/PROFIT	1988 SALES*/PROFIT
Raychem	797.6/48.8	944.4/73.6	1,095.7/125.3
Reynolds Metals	3.753/192	4,284/219.5	5.567/482
Rockwell	12.296/611	12,123/635	11,946.3/811.9
Sheller Globe	863/12.8	774/92	835.4†/NA
Sherwin-Williams	1,553/1.9	1,793/2.1	1,950.5/101.1
Simpson	171/9.9	147/5.3	177.8/10.5
Snap-On Tools	670/331	754/377	854.6/113.3
SPX (Sealed Power)	665/28.5	774/26	877.7/44.9
Standard Products	433/27.2	465/31.5	508.3/34.1
Stanley Works	1,371/78.7	1,763/86.6	1,909/103.5
Starrett	123/12.7	142.2/14.3	169.8/15.8
Superior Industries	148/8.5	169/9.5	200/13
Tecumseh Products	821.1/50.2	951/71.6	1,093.5/70.2
Tektronix	1,352/39.3	1,396/51.2	1,411.9/(16.7)
Teledyne	3,241/238.3	3,217/377	4,400.6/391.8
Textron	5,023/244	7,200/256	7111.2/234.4
3M	8.602/779	9,429/918	10.581/1,154
Timken	1,058/2.7	1,230/10.3	1,554.1/65.9
Trinova	1,447/122	1,681/75	1,918.6/87.8
TRW	6.036/218	6,821/243	6,982/261
Union Carbide	7,828/496	6,914/232	8,324/662
United Technologies	15.670/73	17,170/592	18.087.8/659.1
USX	14.938/1,833	14,836/219	15,792/756
Walbro	98/6.6	110/7	131.7/5.8
Weirton Steel	1,173/30	1,329/80	1,383.8/75
Witco	1,355/65.2	1,428/63.3	1,585.9/91.9

Big Three subsidiaries are not included in this listing. Companies whose sales and earnings have not been available for the last three years have been deleted from the list.

* – *In millions of dollars. Figures taken from* Fortune 500 *and company reports.*

† – *As estimated by* Fortune.

‡ – *As estimated by* Tire Business.

NA – No public listing or not available.

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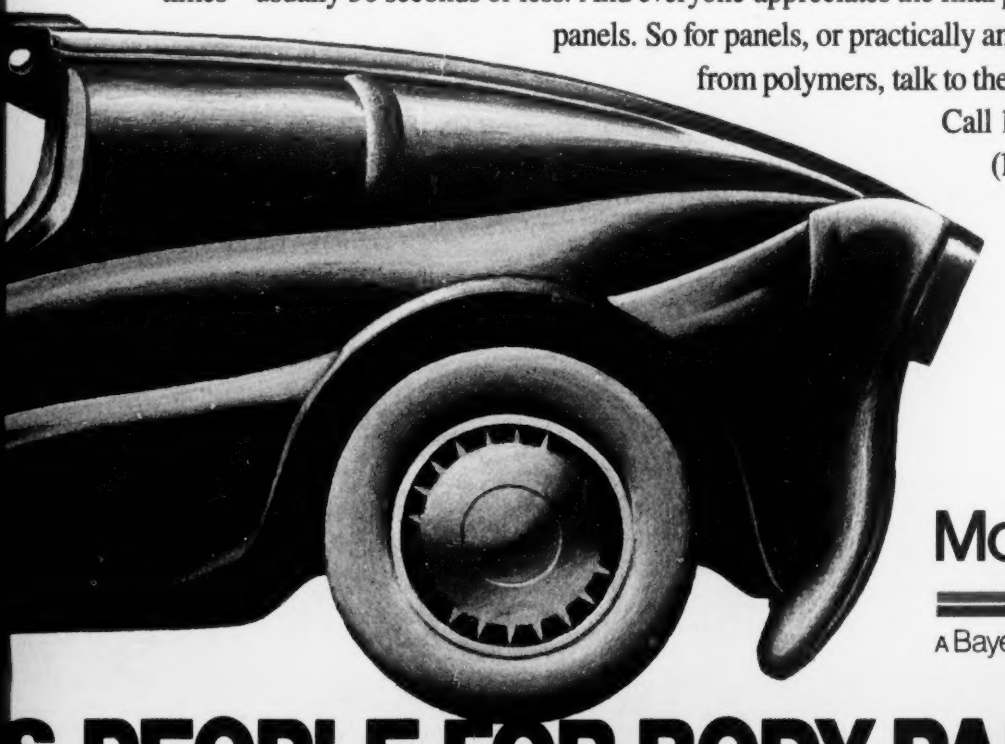

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JANUARY 1990 VOLUME 170, No. 1

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Defining quality is no easy task for today's automakers, but it ranks as one of the most important factors in the retail buy. Find out how automotive quality bigwigs define the 'Q' word on page 36

Cover art by Slideworks

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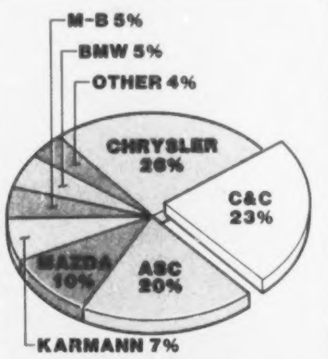
Topping Off

Since Chrysler began the ragtop renaissance in 1982 with its konvertible K-cars, the US droptop market has gone up like a roof in a rainstorm. Convertible sales have grown 438% since '82, according to Cars & Concepts, which performed the surgery on the first K's.

More than 176,000 softtops were sold in 1989 (roughly 1.7% of total US pass car sales), and C&C predicts **the 1990 market to hit 220,000 units**.

Since '82, C&C has de-topped nearly 180,000 Ford Mustangs, completing over 42,000 in '89 alone, making the Mustang an American convertible favorite and undoubtedly contributing to the car's lifespan.

New conversions of 1990-model Chevy Beretta and Olds Cutlass could increase total C&C output to 50,000 units this year. The Brighton, MI specialist assembler hopes to increase that figure to 70,000 units by 1992 by putting the scalpel to new models.



TOTAL CONVERTIBLE INDUSTRY CONVERSION SHARE 1989

Trail-Blazin'?

"With this product we're going straight for the four-door [Jeep] Cherokee," proclaims Harry Turner, product engineering manager for the **1991 Chevrolet S-10 Blazer four-door.** Built off of a stretched version of the two-door Blazer (the chassis has a 6.5 in. section added to it), the four-door variant offers 25% more cargo room in the rear and adds an impressive 15 in. to the three-person rear seating area. (At the press preview, we witnessed several burly six-footers easily accessing the rear seat.)

Available in both 2WD and 4WD configurations, standard features include independent suspension, Kelsey-Hayes four-wheel ABS, and C-P-C's 4.3 L EFI V6. Turner expects the build split to be 75%-25% in favor of the four-door model. He also predicts that more than 40% of the new Blazer's (see photo on p.47) buyers will be sport/truck first-timers. The Olds version of the sport/utility vehicle is the Bravada.

It's In The Bag!

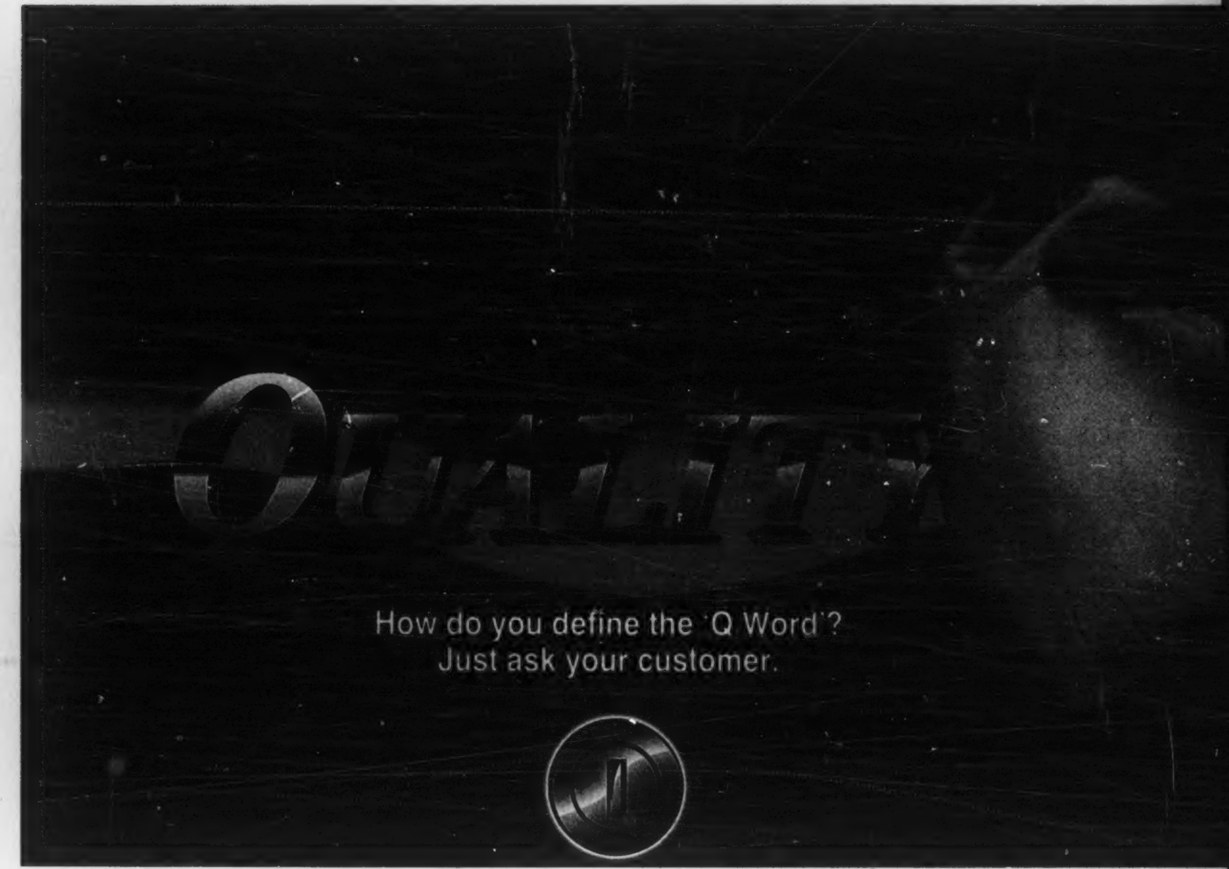
Airbags have been roundly criticized for adding complexity and cost to cars, but maybe it's a two-way street. Informed sources at Ford indicate that the **cost of airbags may eventually become a "wash"** since they will enable engineers to safely remove "crush"—and therefore costs—from the front-ends of vehicles. Additionally, airbags could make possible the sale of smaller vehicles that were previously unable to meet occupant protection standards. So with the current trend toward lower emissions and higher CAFE, it appears airbags are in the right place at the right time.

Toyota Shops In The US

Toyota, in an effort to quiet its foreign critics, has embarked on a program to raise imports to Japan to at least $2.1 billion by 1992—more than **double 1989 projected levels**. Among the main items planned for 1992 importation include 40,000 right-hand drive cars and 100,000 engines per year from the company's Kentucky plant; catalytic converter substrates from wholly-owned subsidiary TABC (600,000 units in '90, 750,000 in '92); a seven-fold increase in semiconductors (Toyota is now importing 21,000 a month); Celica convertibles (1200 units in '91); and a $15 million Cray supercomputer.

Designer's Crash Course

In the 1990s the cost-of-ownership will play an increasing role in customer satisfaction, the experts say. And Tech-Cor, a subsidiary of Allstate Insurance, believes it has a tool the OEMs can use to keep costs lower. It's called the Collision Damage Index and it compares the relationship of repair costs to the retail value of a vehicle. Tech-Cor has developed a 15-page checklist that designers and engineers can use to **improve design to help limit damage in an accident.** "This benefits the consumer by holding costs down and by containing insurance rates," says Don Cameron, president of Tech-Cor. Call Jack Ribbens at 708-541-4545 for a copy of the checklist.



QUALITY

How do you define the 'Q Word'?
Just ask your customer.

The design and manufacturing guys call it "the bottom line." Marketing mavens describe it as "the price of admission." Advertising uses it so much these days that they refer to it simply as "the Q word."

Quality is the automotive industry's most buzzed buzzword. Every vehiclemaker worth his warranty claims his products have it. Many pump slogans like "best built", "most trouble-free", and "highest quality" into their ad copy with almost reckless abandon, hoping they can embed the 'Q word' in carbuyers' brains before the term becomes too trite.

Thanks to intense competition in every market segment, quality is a rapidly moving target. Even econobox buyers want—*expect*—four-and-a-half mil gaps in the doors, a bulletproof, stumble-free drivetrain and controls that move with machine tool precision. Quality experts agree that customer expectations are increasingly defining automotive quality, as well as setting the standards for its execution.

In general, listening to the customer seems to be paying off. New car quality is higher industrywide, according to *Consumer Reports' Frequency of Repair Records* and the J.D. Power *Initial Quality Survey* (IQS)—the two most respected independent barometers that are biased more towards ex-factory quality than towards dealer performance. The *Consumer Reports Frequency of Repair* report, published in *CR* each April, is a model-by-model survey in which owners are asked to check one of 16 categories in areas where they have what they consider to be serious problems. In other words, car owners must think a problem is serious enough to check a box.

In *CR's* 1989 survey, which dealt with a universe of 562,000 cars between May '87 and April '88, average total maintenance and repair costs per model year actually declined (see chart) as they did in the previous year's survey. Robert Knoll, head of automotive testing at *CR*, says that looking over a five-year period, new car quality, on average, is better. He says that his data shows the average number of troubles per car is down across the board.

An '89 car, Knoll says, will have less

WINNING THE QUALITY WAR
Consumer Reports' Frequency-of-Repair Records, 1983-88

TROUBLE SPOTS	WHAT THEY COVER	% OF 'AVERAGE' CARS RECEIVING COMPLAINTS '83	'84	'85	'86	'87	'88
Air conditioning	Compressor, expans.valve, fans, leakage	16	11	9	5	4	2
Exterior paint	Fading, discoloring, chalking, peeling	11	9	6	5	4	2
Exterior rust	Pitting, corrosion, perforation	10	6	3	2	1	0.5
Body hardware	Window, door, seat mech.; locks, belts, head rest.	12	10	10	9	8	5
Body integrity	Air/water leaks; wind noise; rattles/squeaks	10	10	10	9	9	6
Brakes	Power boost/hydraulics; linings; discs/drums;malfunction	16	14	11	7	4	2
Clutch	Lining; pressure plate;release bearing;linkage	14	9	6	7	5	3
Driveline[1]	U-joints; axle; diff.; wheel bearings; prop shaft	4	4	3	2	2	1
Chassis electrical	Starter; alternator; batt.; wiring; instruments; lights; controls; radio; access. motors	18	16	16	13	10	5
Engine cooling	Radiator; heater core; water pump; overheat.	12	8	6	3	2	1
Engine mechanical	Rings; cylinders; pistons; bearings; valves, cam; oil leaks; turbo, overhaul	11	9	6	4	3	1
Exhaust system	Manifold; muffler, cat.converter; pipes; leaks	16	12	7	3	2	1
Fuel system	Stall./hesitat.; carburetion; computer; fuel inject.; fuel pump; emiss. controls; leaks	17	14	11	9	7	3
Ignition system	Plugs; coil; distributor; elect. ignition; chronic pinging; too-frequent tune ups	8	7	5	4	3	1
Suspension	Wheel alignment; springs; ball joints; bushings; shocks/struts	11	10	8	6	3	1
Transmission (man.)	Includes linkage and transaxle	5	3	3	3	3	2
Transmission (auto.)	Includes linkage and torque convert.	8	6	5	4	3	2
Cost Index	Average repair costs per model year	$300	$280	$240	$190	$110	[2]

[1] Except transmission. [2] Most '88 model repairs covered under warranty

Source: Consumer Reports, April 1989

troubles than an '88 in its first year. The important thing Knoll looks for is a pattern from one year to three years old, although he points out that the newest cars don't deviate much from average, because if the percentage of trouble is, for example, over 1%, then it's difficult for them to do much better than that.

How do American cars compare with Japanese cars in the *CR* survey? Knoll says they're getting a lot better.

"You can especially see it in the Body Exterior Rust and Engine Mechanical categories [which have improved for all cars]. The Japanese have really stayed about the same," he says, adding that he doesn't think the Japanese cars will improve as quickly in this area as they have in the past.

According to Knoll, the *CR Frequency of Repair* data shows that some cars get better with age – especially American cars like the Chevy Caprice and Ford Crown Victoria. Some, particularly the Europeans, get worse.

Knoll, a 24-year veteran of *CR*'s automotive test department, believes the longer customers own a vehicle from new, the less they seem to care about the 'perceived quality' items that are so important in the showroom – door thunk, body panel fit, etc. They begin putting up with a certain degree of IP squeak and deteriorating weatherstripping, in exchange for what he maintains is the real yardstick of automotive quality – daily reliability.

The J.D. Power IQS, conducted on both new car and truck owners, also serves as an early reading of how new-model vehicles are performing in customers' hands. The IQS is based on problems per 100 cars during the first 90 days of ownership.

For the 1989 IQS, Power sent out 65,000 surveys to new car owners and achieved a 38% (24,700) response rate, according to Bill Fleming, the J.D. Power and Associates research analyst who wrote the 1989 Initial Quality Survey (IQS). The latest data shows that overall, the industry's initial new car quality is clearly improving, averaging 153 problems/100 cars. That's an improvement of 21 problems/100 cars versus 1988.

Overall Japanese IQS performance, at an average of 119 problems/100 cars, also was up 21 problems/100 cars,

> **I think the whole of the industry has had too short a vision [on the depth of its product quality].**
>
> – Bob Marshall,
> executive director
> corporate quality,
> Ford Motor Co.

handily beating the Big Three's 163 problems/100 cars and the Europeans' 204/100. In the 1988-89 period, the domestics' initial quality improved by 14 problems/100 cars.

Power only publishes the top 10 IQS nameplates because "We like to use the carrot rather than the stick," explains Fleming. Listing the marques with the worst initial quality would not have a positive effect on the manufacturers, he says.

Just what is 'quality' as it applies to new vehicles today? According to two of the domestic industry's top quality guns, there are no standard answers. They say the definition of quality will always be elusive, as customer expectations continue to rise.

"I define it as 'exciting, dependable, trouble-free operation,'" says Ed Czapor, VP and group executive in charge of quality and reliability at GM. He stresses that the myriad of choices in the marketplace are responsible for raising the customer's expectations of quality.

"The customer is walking into the showroom and making a decision on paint finish today!," says Czapor. "The thing we're battling right now, that the whole domestic industry is battling, is perception versus reality."

In Czapor's view, American vehicle quality is really much better than it's perceived, whereas Japanese quality is good but is seen as being good. He says just getting people into vehicles is an important step for the domestic industry and is "something we've really got to work on."

Bob Marshall, Ford's executive director of corporate quality, says that as a process based on design, manufacturing and dealer performance, quality means "increasing Things Gone Right, more than reducing Things Gone Wrong."

This same philosophy has been a guiding tenet in Honda's design and manufacturing process. Shoichiro Irimajiri, former president of the Marysville operation and now a Honda managing director, once told *AI:* "If you succeed in reducing manufacturing defects from two in 100 to one in 100, you may be tempted to think you did a good job. But Mr. Honda would always remind us that the customer is only buying *one* product. If the customer gets that *one* bad product, for the customer 100% of the product will be bad."

Both domestic quality czars agree that customer perceptions of quality must drive automakers in setting their quality goals – something J.D. Power's Bill Fleming calls 'quality in the eye of the customer.' That means satisfying buyers' expectations of comfort, operation, performance, finish and reliability, coupled with fanatical customer care in the crucial 30-90 day period after purchase.

"Customer satisfaction is at its highest level when the guy gets his new car," notes Bob Marshall. "After that, it deteriorates. So at delivery, the car has to meet all of the customer's expectations. We still have a better job to do; we build a hell of a lot of cars and still hear complaints that distress us."

Where are the industry's major quality weaknesses? To GM's Czapor, they are still fit/finish and body assembly. *CR's* Knoll points to the electrical problems and driveability demons which continue to top most independent problem lists (as they've done on the *CR* roster for years), despite strides in systems design and hardware reliability. Ford's Marshall says aesthetic deterioration, especially materials aging, is 'everyone's problem.'

To measure quality, the automakers rely heavily on internal plant audits. GM, for example, has an audit called Customer Oriented Vehicle Evaluation – COVE. It is conducted at least once a month in each assembly plant, by trained auditors that work under Dick Roden, corporate director, quality and reliability. According to Roden, who runs GM's driveability and assembly plant audits, his team arrives at the plant completely unannounced, then selects 20 vehicles at random – 10 built the previous week and 10 built the current week.

The auditors conduct a fit and finish review, including underbody and underhood analyses, all under bright lights. They do a four minute water test. They look at image reflection in the paint, then drive the vehicles over a 10-mile course as a customer would.

Roden says that although no actual customers are present, his teams try to put as much customer input into the audit as possible. GM auditing standards are developed by running clinics, one of which is planned for early 1990 to determine levels of wind noise, which Roden says has been a source of GM customer complaints.

Most surveys show that powertrain quality – performance and reliability – is most important to customers. To this end, GM has taken a drive schedule that Roden says 91% of GM owners go through and has applied it at the Proving Grounds over a mileage test. They put the car in an overnight soak, then count how many seconds it takes to start the engine and whether the engine stalls or sags. Cold cycle traffic manuevers and a transmission evaluation are next, to cap a 10-mile cold/10 hot test program.

This audit is completed on five engine families, then on every combination of GM engines and transmissions. It's evaluated on a scale of 100, and reported monthly to corporate engineering by engine family. GM also runs a proving ground test that simulates 10 years of vehicle usage in a 12-month period, by running the vehicles around the clock. Czapor and Roden believe that's a major indicator of long-term reliability, although obviously an automaker can only put so many vehicles through such a test.

Manufacturers are now adjusting their internal auditing because of customer wants and expectations. Earlier audits were frequently based on safety-related quality concerns, and the conduits for customer feedback were often not open. Now, Quality

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What areas of quality still need improving? The OE quality bosses say it's fit/finish and materials aging. But driveability demons still haunt the industry.

Function Deployment (QFD; see Jan. '89 *AI*, p. 30) gives OE engineers customer input at the design stage, drastically affecting initial quality.

"In the past there was often a difference between what an engineer thought was acceptable quality, and what the customer wanted in quality," says Ed Czapor. "Now we get the customer input right up front. Now the engineer has that information in his knowledge bank when he designs."

"The Voice of the Customer and the voice of the engineer aren't necessarily the same," adds Ford's Marshall. "Nearly two years ago we did some driveability correlations between how the customer sees driveability and how engineers evaluate it. Our engineers evaluated it somewhat differently."

He says engineers tend to get 'mentally corrupted' by what they think is practical or not. "If you start saying, 'To hell with what's practical – here's what the customer says is a problem,' they take a different attitude about spending money," Marshall says.

Both he and Czapor note relatively simple changes their engineering teams have made to improve decklid and door closing effort, to suit the customer's expectations of quality in this area. "QFD says that if you're going to be competitive in a certain price class, this is how your door should operate," Marshall states.

Automakers are interested in the traditional defects per vehicle and defects per 100 vehicles, because they can dial this data back into design and manufacturing. But J.D. Power's Fleming maintains that since buyers want something that will keep them satisfied over time, a vehicle can actually have a manageable number of defects from the factory, *as long as they're fixed quickly.*

In other words, there is not always a direct correlation between quality, both initial and long-term, and customer satisfaction/loyalty. This is particularly evident in the upper strata of the import luxury segment. Product uniqueness, image, performance, and how the dealer strokes the customer all play a role in the owner's perception and expectations of quality.

INITIAL QUALITY 1989
The Top 10 Models

1.	Nissan Maxima
2.	(tie) Buick LeSabre, Toyota Corolla
4.	Ford Crown Victoria
5.	Mercedes-Benz S-class
6.	Mercury Tracer
7.	Toyota Cressida
8.	(tie) Subaru Loyale sedan, Subaru Loyale coupe
10.	(tie) Buick Riviera, Mercedes-Benz 190 E/D

Source: J.D. Power and Assoc.

INITIAL QUALITY 1989
The Top 10 Marques

	reported problems per 100 cars
Mercedes-Benz	103
Porsche	106
Nissan	111
Honda	111
Toyota	117
Acura	120
Buick	121
Mazda	133
Mercury	134
Daihatsu	140
INDUSTRY AVERAGE	153

Source: J.D. Power and Assoc.

"People that buy in the upper market segments are usually well-educated," says Fleming. "They know about a certain marque's problems, and realize, in some cases, they'll be buying those problems to a certain extent."

George Parker, associate administrator for enforcement and director of vehicle safety compliance at NHTSA, agrees. Although his agency only maintains a database on safety-related complaints (including driveability), each year it receives some 20,000 quality-related complaints of all types. "For some reason, people that own luxury cars don't complain," comments Parker.

Is this a result of vehicle cost? Both Power's Fleming and *CR*'s Robert Knoll say that some owners may be reluctant to come clean about their new $60,000 Bahnpanzer's problems because it might reflect on their prowess as a car buyer. But the other side of the coin holds just as true: the more money spent on a vehicle, the better the product is expected to be and the more willing the buyer is to tell the truth about it.

Even in the market's proletarian segments, there are plenty of examples of cars with spotty initial quality enjoying great sales success. For example, both Fleming and Knoll agree that in the Taurus's first 18 months of production, the car's fresh styling and new image offset many early problems that may have sunk other cars.

"In the Taurus' case, Ford did a great job in promoting the car. They really played up the 'Quality is Job 1' in the ads," notes Fleming, who adds that automakers can heighten the expectations of new car owners too much. He says that all manufacturers run a risk of letting their marketing and advertising get out ahead of a vehicle's actual initial quality performance in the marketplace. Each new vehicle, after all, has to prove itself: That the popular press pounced on Lexus after their LS400 recall is a lesson here.

Ford's success with Taurus was that in the early days, they had enough Things Gone Right that it simply

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> **The thing the whole domestic industry is battling right now, is the perception [of quality] versus the reality.**
>
> –Edward Czapor,
> VP of quality and
> reliability, GM

swamped the Things Gone Wrong–it was a very customer-driven car in its design and content. However, quality boss Marshall says Ford will never again launch a car at a quality level that was less than the prior model's, as they did with Taurus. He admits that the project's many 'entrepreneurial' late changes (the old moving target again) and lack of discipline in some areas of the process helped cause initial quality problems. Marshall says lessons learned from Taurus initial quality has helped Ford launch a better Town Car.

To even better assess new vehicle quality, why not look beyond 60-90 day initial ownership reports and 15-month surveys? J.D. Power's Bill Fleming indicates that his company is working on a study that examines much longer ownership periods. Ford's Bob Marshall believes that on vehicle quality, "the whole of the industry, Ford included, has had too short a vision." Ford, which does 12-month surveys, has now gone out to six years. And in some areas, like corrosion, they're starting to look at 10-year old vehicles.

"We started doing trim surveys about three years ago," Marshall notes. "Now we do them at the same time we do corrosion surveys, and we see deterioration in places like Florida where the headliner's come down."

According to Marshall, as a result of these surveys, Ford has upgraded all of its trim specifications, driving plastics and trim suppliers from the survey results. "We've quadrupled our requirements for fading of interior cloths," he says. "Our objective, as a company, is to have the best satisfaction level at the time the customer trades his vehicle in. And I can tell you, we're obviously not there."

If average trade-in periods vary from about 32 months to five years, why should an automaker care about quality beyond that? Ed Czapor says GM targets 10 years as the useful life of its vehicles. He cites used car values as one reason to improve long-term quality–they make a big difference in whether the owner can trade or not. Reliability is a big factor in price, so price/value is very important. And people are keeping their vehicles longer and trading less frequently.

Bob Marshall says that if Ford's current 90% initial owner satisfaction levels were to sink to 50% after four years, few would buy another Ford. "If you could somehow keep that up to 80% after four years, you're going to conquest your competition," he notes. "If people are happy with their car over an extended period, they form an affection for the car and an affection for the company. And that gives you a hell of an edge on the loyalty."

What it all boils down to is that perfect vehicle quality is a long way off. There will always be a range of quality between companies, even if that range narrows to a razor's edge. There will be quality gaps between an individual maker's models, and even between different models built on the same platform. The key to improving quality is improving the connection between customer and designer, customer and engineer, customer and planner.

The fewer unplanned trips back to the dealer, the better the customer feels about the product. And if you can take care of that customer in that critical 30 to 90 days, you're going to have a happy customer. AI

COMPLAINTMOBILES
NHTSA's Top 10, 1987-88*

CAR	1987-'88 SALES	TYPICAL COMPLAINTS	COMPLAINTS per 10,000 CARS
1. Oldsmobile Delta 88	327,058	Driveability, brakes	10.5
2. Plymouth Horizon	107,602	Driveability, electronic ignition	10.1
3. Acura Legend	125,483	Surging at idle	10.0
4. Pontiac Bonneville	210,364	Driveability	9.8
5. Buick LeSabre	282,566	Driveability, brakes	9.7
6. Oldsmobile 98	145,349	Driveability	6.7
7. Mercury Sable	223,736	Driveability, brakes	6.6
8. Nissan Maxima	167,720	Surging, transmiss., steering, tires	5.5
9. Mazda 626	140,793	Transmission, suspension	5.4
10. Ford Tempo	504,473	Driveability	5.2

*Based on sales of over 100,000 units each. 'Driveability': combination of surging/stalling

C2150-3

CHILTON'S

FEBRUARY 1990

AUTOMOTIVE INDUSTRIES

THE PEOPLE – THE PRODUCT – THE PROCESS

1990 MAN OF THE YEAR

HONDA CEO TADASHI KUME

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The New Big Three

Not many companies brag that they're Number Three. But don't be surprised to hear Honda do so. By year end – with the extra production from its East Liberty, OH assembly plant – **Honda could sell more passenger cars in the United States than Chrysler.**

Chrysler, for it's part, takes a rather cavalier attitude about losing its Big Three ranking. "I don't know what the importance of being Number Three or Number Four is. What Honda does Honda will do," says Chrysler's vice chairman, Bennet Bidwell.

Thank you, Infiniti...

For pulling those stupid ads. We just **couldn't take it anymore** – the rocks, the trees, the fish, the birds and the narrator, who we wanted to choke. Now rumor has it that the most abstract ad campaign in modern times has been cancelled. Kaput. So much for experimental advertising. Now if we could only remember what your cars look like...

IMPORTant News

Flash from Japan! Figures just released show that the Honda Accord is the only American-built nameplate to make the **top ten list of new import car registrations in Japan**. But equally important as the relative rankings, are the numbers of units involved. Clearly the market is headed nowhere but up – but where are the Big Three?

Japan Import Registrations

Vehicle	*Country*	*Units Sold*	*'89/'88%*	*% Share*
Volkswagen	W.Germany	34,674	24.1	19.2
BMW	W.Germany	33,076	23.3	18.3
Mercedes	W.Germany	31,511	39.3	17.5
Audi	W.Germany	14,306	26.1	7.9
Austin Mini	G.Britain	9,919	47.3	5.5
Volvo	Sweden	7,122	53.7	3.9
Accord	U.S.A.	4,697	-12.9	2.6
Peugeot	France	4,586	94.0	2.5
Porsche	W.Germany	4,053	66.5	2.2
Citroen	France	3,908	61.7	2.2

Source: JAIA

Daddy, What's a Station Wagon?

"The minivan has become **a replacement for the station wagon,**" says Dr. Thomas O'Grady, president and chief analyst of Integrated Automotive Resources, Inc.

Before 1984 – the year Chrysler introduced its minivans – small vans accounted for no more than 31,000 sales, while station wagons took 10% (895,000 units) of the domestic market. Since that time, station wagons sales have dropped to 590,000 units in 1989, while minivans grabbed 850,000 sales last year.

"The growth in minivans," says O'Grady, "has come from the aging of the Baby Boomer generation, and the realization that these vehicles are suited to a number different purposes."

Even so, automakers have not abandoned the station wagon market, but the trend is to an even greater relaince on sales of minivans and multi-purpose vehicles.

A Brand New Market

"I see Eastern Europe as the outstanding business opportunity confronting us in the next couple of years," notes John Day, president of Allied Signal's Automotive Group. "It's a only a two- to three-million-unit market today and **there's no reason why it can't grow** to 12 or 13 million units – as big as Western Europe." He adds that the automakers and suppliers which react the fastest are the ones who are going to get that new business. Allied- Signal now has liscensees in Poland, Hungary and Yugoslavia.

MILKING THE CASH COW

AMERICA
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Or, how Chrysler Finance makes its millions.

by JOSEPH M. CALLAHAN

"Cash cows" have been defined as business operations that produce significant profit for a company when it needs money for additional investments, or when the profit of other divisions is faltering.

Thus it's appropriate to call General Motors Acceptance Corp. (GMAC), Ford Motor Credit Co. (FMCC) and Chrysler Finance Corp. (CFC) the cash cows for their companies. These finance arms are important now – but they'll be even more important in the months ahead, as the industry heads into a sales slow-down.

In the first nine months of 1989, the finance companies had a total net profit of $1.56 billion, or 19.4% of the industry's total profit of $8.061 billion.

Chrysler Finance is the smallest of these financial organizations. It's still a good-sized business, with over 7000 employees in 443 US, Canadian and Mexican branch offices. And a good case can be made that CFC is also the most successful of these companies in terms of its contribution to the parent. With a $198 million profit in the first nine months of 1989, CFC produced 19.4% of Chrysler's $1.02 billion profit in this period. However, its contribution would have been 27.8% if Chrysler hadn't sold 75 million shares of its Mitsubishi Motors stock for $309 million.

By contrast, GMAC produced 24.4% of GM's $3.520 billion profit for this period and FMCC earned 14.3% of Ford's $3.521 billion net profit.

For the third quarter of 1989, Chrysler Financial reported net earnings of $76 million, the highest for any quarter since the company was founded 25 years ago. And gross receivables (outstanding loans) have risen to an incredible $40.2 billion, up from $36.6 billion a year earlier – almost a 10% increase.

BIG THREE FINANCE COMPANY PROFITS Jan.-Sept. 1989

	Finance Co.	Corp. Profit	% Of Total
GMAC	$3,520	$859	24.4
FMCC	$3,521	$503	14.3
CFC	$1,020*	$198	19.4

*Includes $309 million from sale of 75 million shares of MMC stock.

While CFC persists in its fundamental mission to be the banker for Chrysler's 5000 dealers, CFC chairman John P. Tierney says, "Two things are really responsible for our profit increase. One is that the company is 7%-8% bigger than it was last year. The other is our substantially expanded insurance operations."

According to Tierney, CFC provides two kinds of insurance – the traditional insurance offered as an option to dealers with wholesale financing, and Chrysler's 'Pentastar Protection.' The latter, started in 1987, covers a dealer's building, workman's comp and liability.

The success of this rapidly growing business, Tierney says, is based on CFC's determination to maintain consistent premiums, plus a top-notch loss-control program based on the principal that if claims are controlled, the insurance will be cheaper in the long run.

Since taking over at CFC, Tierney, who was the finance VP of American Motors until it was absorbed by Chrysler in August, 1987, has emphasized a strategy of "securitization." This consists of selling its retail automobile and other loans to other lending institutions while CFC continues to collect and service these loans.

Funds from this securitization have then been turned over to its other two more profitable financing operations. These are Chrysler First, which loans money to consumers and small businesses, and Chrysler Capital, formerly E.F. Hutton Finance, which handles several billion dollars worth of commercial lending and leasing.

These two companies are involved in 16 non-automotive programs, including the leasing of 21,000 railway cars, a rapidly growing and large computer-leasing program, over $1 billion in marine financing, the funding of many alternative energy programs, the financing of numerous apartment houses and small commercial buildings, many LBOs (limited buy-outs), second mortgages, jet aircraft leasing and others.

In recent years, GMAC has entered the home mortgage business and Ford Motor Co. has invaded the S and L field. But CFC has avoided both of these areas, believing that home mortgage profits are too slim and that the troubled S and L's are not needed in the US since banking was deregulated.

When one thinks of big loans, the thought immediately comes to mind that in the early 1980s, Chrysler Corp. survived partly because of a $1.2 billion government loan guarantee.

"I wasn't here then," laughs Tierney when asked about this, "but when Chrysler Corp. lost its credit rating, CFC also lost theirs and wasn't able to get additional financing. The funds it had were needed for dealer financing."

For the future, CFC's goals are to support the sale and distribution of Chrysler and other vehicles, especially with the use of new technology, including rapid credit checks. Tierney explains that they'll continue to diversify and grow in the areas they're now in. Also, CFC is eyeing Europe and other world markets for new financing opportunities. AI

AUTOMAKER QUARTERLY REPORT

by DR. THOMAS O'GRADY

The end of 1989 brought an automotive downturn. The automaker's responses to current problems will likely determine the market shares and positions they will hold over the next few years.

GM, which has the opportunity to recover, is instead cutting back on advertising and delaying products, as in the past. Without a strategy change, we expect GM's share of the passenger car industry to drop to between 26% and 28% in the nest few years. If GM is willing to invest in its new products – rather than worry about short-term profits – it could reverse its current sales slide.

Chrysler, which appears to be in trouble, is finally getting that old survival spirit back again.

As the 1990 model year commences, we see domestic automakers starting incentives earlier than ever before on most of their 1990 models, even offering cash rebates on some newly introduced vehicles. But the year's natural disasters kept more customers away from the showrooms during the fourth quarter of '89.

> *Will 1990 be the year of the incentive?*

Even the Japanese are struggling in today's market. However, Mitsubishi looks especially good right now. Mitsubishi nearly doubled its passenger car volume since 1988, making it the ninth largest automaker in the US – and bumping Subaru from the list of top-ten car manufacturers. With its recent growth, however, Mitsubishi will become a marketing target for the other Japanese car manufacturers for the first time since it entered the US market.

The Honda Accord topped the best-selling nameplate list for 1989, making the first time an import holds that position in a calendar year. Honda and Toyota each had two models (all four of which are produced domestically as well as imported) on the top-ten list during the quarter.

More detail on automotive sales and production is available in *Fast Track News*, a newsletter published 60 times a year by Integrated Automotive Resources, Inc. Call 215-687-1559 for subscription information. AI

Dr. Thomas O'Grady is president and chief analyst of Integrated Automotive Resources, Inc. in Wayne, PA.

WHAT'S HOT!
Domestic Auto Sales
4th Quarter 1989

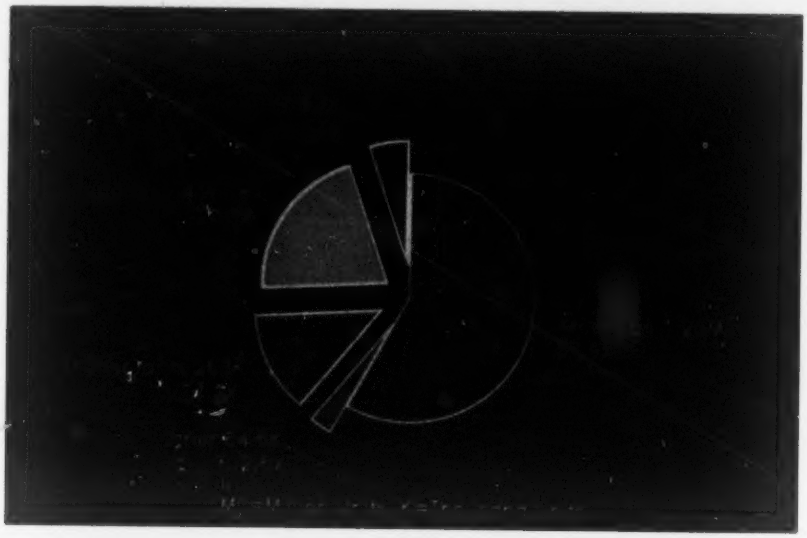
Carline	'89	'88	% Change
Accord*	99,419	99,147	0.27%
Taurus	75.534	87,710	-13.88%
Cavalier	65,049	75,852	-14.24%
Camry*	61,956	69,088	-10.32%
Escort	60,386	93,205	-35.21%
Civic*	56,875	46,853	21,39%
Tempo	55,263	68,445	-19.26%
Lumina	50,172	--	--
Corolla*	49,735	59,541	-16.47%
Corsica/ Beretta	46,206	72,874	-36.59%

* – Includes imports

US Passenger Car Market Shares
4th Quarter, 1989

Manufacturer	'89 Sales	% Total	'88 Sales	% Total	% Change
General Motors	672,140	34.70%	880,698	37.58%	-23.68%
Ford	433,747	22.39%	538,626	22.98%	-19.47%
Chrysler	213,843	11.04%	272,170	11.61%	-21.43%
Honda/Acura	193,600	10.00%	204,948	8.74%	-5.54%
Toyota/Lexus	173,229	8.97%	189,127	8.07%	-8.14%
Nissan/Infiniti	103,173	5.33%	105,771	4.51%	-2.46%
Mazda	49,945	2.58%	52,884	2.26%	-5.56%
Hyundai	37,219	1.92%	55,316	2.36%	-32.72%
Mitsubishi	31,532	1.63%	13,822	0.59%	128.13%
VW/Audi	27,923	1.44%	30,428	1.30%	-8.23%
TOTAL CARS	1,936,851	100%	2,343,790	100%	

(Continued on p. 156)



Passenger Car Market Share By Geographic Base

Fourth Quarter 1989

Manufacturers	Total Sales	Total Market Share
American	1,184,398	57.81%
Japanese	437,136	21.34%
European	103,686	5.06%
Transplants	268,988	13.13%
Other Imports	54,675	2.67%
Total	**2,048,883**	**100.00%**

4TH QUARTER 1989 DOMESTIC LIGHT TRUCK PRODUCTION*

COMPANY	FULL-SIZE TRUCKS	COMPACT TRUCKS	FULL-SIZE VANS	COMPACT VANS	FULL-SIZE SPORTS UTILITY	COMPACT SPORTS UTILITY	TOTAL	
							4Q '89	4Q '88
CHEVROLET	133,145[1]	38,078	38,181	48,345	19,025	26,859	303,633	374,899
FORD	160,628	70,234	38,222	47,554	14,100	29,596	360,343	403,318
GMC	47,564[1]	9,924	13,465	11,666	8,804	9,011	100,434	112,878
CHRYSLER	16,897	20,341	23,088	122,711	---	---	183,037	200,201
JEEP	---	3,444	---	---	1,495	49,325	54,264	81,518
NISSAN	---	31,797	---	---	---	---	31,797	24,908
PONTIAC	---	---	---	7,120	---	---	7,120	---
OLDS	---	---	---	3,730	---	---	3,730	---

[1] Includes Suburban and P-model. *Built in the US and Canada.

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TOYOTA'S UNCONVANTIONAL PREVIA

MARCH 1990 VOLUME 170, No. 3

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The Japanese Are Coming – Again!

Insiders say Mazda will **invade the US luxury market** in 1992 with a very Jaguar-like challenger.

From its traditional grille opening to the horizontal taillights, the new four-door Mazda is said to look like a longer and smoother XJ6. Technical specifications are as yet unclear, but insiders say the big rear-drive Mazda will be powered by a dohc 4.0 L V8, and built off the new Mazda Cosmo chassis.

It is possible the new challenger will offer the option of either the Cosmo's three-rotor turbocharged Wankel, or a street version of Mazda's recently introduced 3.5 L W12 racing engine.

Regardless of which engine is chosen, the new car will have about 300 hp on tap.

Suspension will be fully-independent, with some form of adaptive damping control. Mazda has offered electronically adjustable shocks on its sporting cars, but it is thought the new car will offer an air-over-hydraulic suspension system like Citroen has on its new XM. (Mazda is Citroen's Japanese sales agent.) Computer-controlled, four-wheel-steering is also under consideration.

Black Gold – Texas Tea

Current US oil reserves are so low that if Uncle Jed were "shootin' at some food" in today's market, he'd never get the chance to move to Bev-erly (Hills that is). In fact, the American Petroleum Institute points out that 1989 **oil imports accounted for 46% of US oil consumption**, compared to just 31% in 1985. Further analysis of the current numbers show that the US (ranked ninth in oil reserves at 26.8 billion barrels) is exhausting its supply at a faster rate than any other oil producing country.

ENERGY USERS, ENERGY HOARDERS

Annual Oil Production		Proven Oil Reserves	
Country	Barrels (Billion)	Country	Barrels (Billion)
1. USSR	4.3	1. Saudi Arabia	169.0
2. USA	2.9	2. Iraq	100.0
3. Saudi Arabia	1.8	3. Iran	92.8
4. China	1.0	4. Abu Dhabi	92.2
5. Mexico	0.953	5. Kuwait	91.9

Chart: API

Nissan's New Superlight Automatic

Nissan's new Sentra, which will debut this year, will feature a new superlight four-speed automatic transaxle that improves both fuel economy and acceleration. Weighing just 136 lb, the new tranny is 22% lighter than the current Sentra unit, and stands 3.15 in. and .75 in. shorter in height and length. Designed for planetary gear transaxles, it **features a superflat torque converter** – 17% shorter than current models. Nissan says this compact size reduces converter weight as well as moment of inertia by 20%. Other features include molybdenum steel gears; many aluminum components including the oil pump; a 27% reduction in rotating part weight and 9% less internal friction.

The New Bed Buddies

It was like the "mating of two porcupines" is how Chrysler vice-chairman Gerald Greenwald describes the conception of New Venture Gear, the new joint-venture between Acustar's New Process Gear division and GM's Hydra-matic plant in Muncie, IN. NVG, headquartered in Troy, MI, is the first manufacturing **jv between two major US automakers.** Greenwald says the deal, in which Chrysler owns 64%, is a "natural fit" – New Process lacked floorspace and the Muncie plant (operating at just 40% capacity) needed the work. NVG will build 4x4 transfer cases, viscous couplings, manual transmissions and differentials for both automakers, as well as solicit business from other sources. It will be responsible for its own R&D and will develop products independently.

NEW VENTURE GEAR

Packing The Bag

AIRBAG REPLACEMENT COSTS	
BMW	$2650 (approx.), all models. Incl. module, steering wheel, wire, sensors, controller
Chrysler	$442, all models. Incl. module, clock spring
GM	$850 ave. all models. Incl. module
Ford	$600 driver-side/$750 pass-side, ave. module cost
Mercedes	$1300 driver-side/$1400 pass-side (approx)
Volvo	$1200 all models, module only
Saab	$2600 all models. Incl. $1052 module; $1074 electronic unit; $500 sensors, steering wheel, contact unit, etc.

We've recently heard some hot air blowing around Detroit regarding the **cost of replacing airbags** after they've deployed. But when some numbers started to sound outrageous – like "over $15,000" to replace both bags on the new Mercedes SL – we had to check it out. Realizing that the price of replacing airbags is usually 1) covered by insurance; 2) no big deal, compared to the cost of fixing lots of bent sheet metal; and 3) better than facial surgery, we submit this random sampling of retail parts costs for airbag replacement. Labor is not included, but according to Bob McAnally, editor of the famed Chilton *Flat Rate Labor Guide*: "The mentality of the retail trade is such that airbags are a sophisticated system and these are sophisticated parts – so they're gonna soak your ass for them."

Fall Down, Go Boom

The airbag business is booming in more ways than one. Last year the only plant in North America (owned by ICI) that makes sodium azide – the propellant that fills up airbags – caught fire. And TRW's azide mixing plant in Mesa, AZ suffered an explosion. But now help is on the way. Next year TRW will begin grinding and **blending azide with a heavy water content**. And the mixture will be squeezed dry, not blown dry. Then, in 1992 Allied-Signal hopes to introduce a solid propellant. Good thing. By 1995 total airbag sales could reach $4 to $5 billion – provided they make it to the market.

DE/Mec

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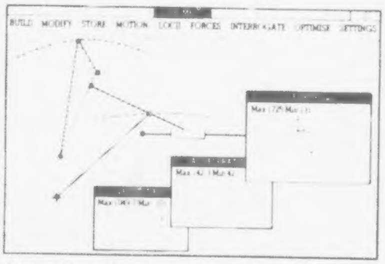

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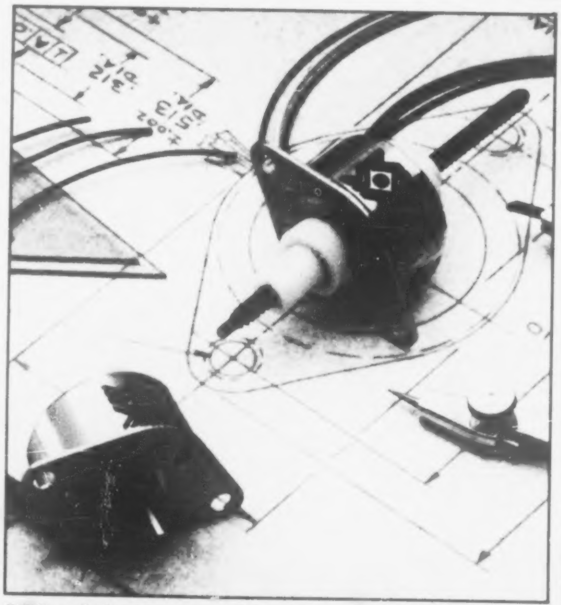

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Diesel Re-Do

Targeting nearly 20% of your strongest-selling car line to be diesel-powered may sound crazy today – unless you're Volkswagen. VW hoped to sell 12,000 of its re-introduced Jetta Diesels last year; it sold only 4000, while gasoline Jetta sales topped 55,000. The **12,000 unit sales target** still stands for 1990.

"Last year the diesel was a base model and sold for $11,320," says Larry Nutson, VW manager of product information, who notes that for '90, the car wears upscale GL trim and sells for nearly $1000 less. Nutson also says VW is leaning towards offering a reborn Golf Diesel. Although a recalibrated injection pump, new combustion chambers and injectors have cleaned up VW's diesel, it still won't pass California NOx and particulate emissions standards.

M-B Aims Low

Despite having 410,000 diesel passenger cars – 40% of all Mercedes-Benz cars in operation in the US – on the road, Mercedes-Benz has set **a modest sales goal** for its new 300D 2.5 Turbo and 300SDL models. The combined sales rate for the new cars is 4000 units per year, which represents about 7.5% of the company's 49-state sales target (the cars do not meet California emission standards). However, Mercedes officials say diesel production can be adjusted to meet demand, and expect sales to reach 12,500 units in 1991.

The Cars Are The Stars

Unlike the US market, **new car registrations – and production – in Japan were up for CY 1989**. The following chart, from Toyota, is a summary of domestic Japanese registration activity for that year.

NEW VEHICLE REGISTRATIONS IN JAPAN JAN.-DEC. 1989

Company	Total Vehicles	'88 vs. '89(%)	Cars	Trucks & Buses	Share (%)
Toyota	2,308,863	8.9	1,760,966	547,897	31.8
Nissan	1,319,078	13.7	997,002	322,076	18.2
Mitsubishi	665,227	6.9	233,002	432,225	9.2
Honda	663,138	8.2	457,570	205,568	9.1
Suzuki	510,837	-2.1	140,204	370,633	7.0
Daihatsu	509,528	-2.3	157,047	352,481	7.0
Mazda	483,769	19.4	296,149	187,620	6.7
Fuji Hvy. Ind.	313,241	-.5	138,104	175,137	4.3
Isuzu	203,407	-1.1	43,395	160,012	2.8
Import Vehicles	181,980	35.1	180,978	1,002	2.5
Hino	59,615	8.3	--	59,615	0.8
Nissan Diesel	38,021	14.8	--	38,021	0.5
Cars Total	--	18.5	4,404,417	--	--
Trucks Total	--	-4.3%	--	2,852,287	--

Cutting Through The Haze

The Rofin-Sinar Laser Group, part of Siemens A.G., is predicting **slower laser growth** in the $60 million US market during 1990, due to falling auto sales and overcapacity concerns. However, the company expects strong sales growth to continue in both Japan and Europe.

Future laser fiber optics developments include reducing the fiber core width for increased beam quality, creating fiber optic systems for CO and CO^2 lasers, and developing multi-kilowatt fiber optic Nd:YAG (Neodynium-doped yttrium aluminum) lasers. The auto industry uses 27% of CO^2, and 3% of Nd:YAG lasers.

But the biggest barrier to increased laser use in the US is management, says Dennis Fortino, president of Rofin-Sinar, Inc. "We have a conservative posture in the US. Management doesn't care about the long-term benefits as much as the short-term return on investment."

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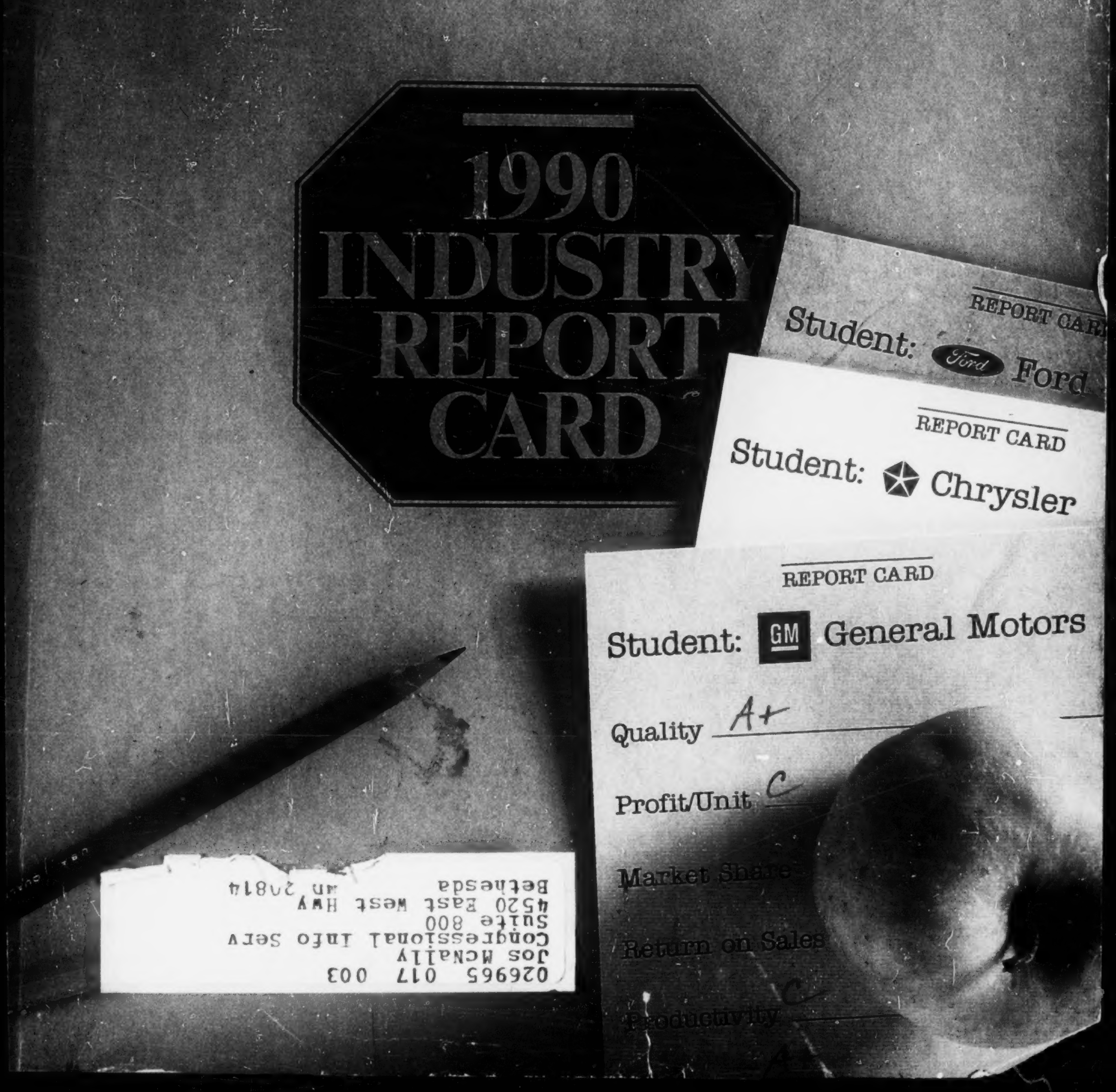
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Quality A+
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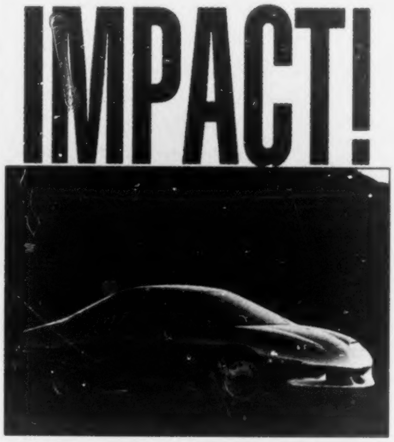

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1990 INDUSTRY REPORT CARD

Poorer, but more efficient.

by JOHN McELROY

The boom times are over. For the last seven years, the American auto industry enjoyed one of its strongest growth rates on record. But now, with higher interest rates, substantial overcapacity, and a saturated market, the brutal laws of capitalism are separating the well-run automakers from those that have been just plain lucky.

In 1989, the US market fell by 1.23 million units (7.8%). That's quite a drop, but it still represents the eighth best year in the history of the industry.

While the domestic automakers found it tough going, the imports fared well. Total import car and truck sales reached 3.86 million units, (26.5% of the market), up from 3.78 million units (23.9%) in 1988.

But the Europeans—except Volvo—ran into trouble. Their 1989 sales totaled 479,000 units (3.3%), down from 569,000 (3.9%) in 1988. The Koreans lost a lot, too. Including captive imports, their sales fell to 297,000 units (2.0%), down from 397,000 (2.5%) in 1988. Obviously, it was the Japanese who made the big gains, though Mazda and Subaru lost both sales and share.

But so much for the imports. To help you keep track of how the Big Three fared in 1989, each automaker has been graded according to how it performed in six different categories over a period of time. Each grade is given according to the company's own trendlines. In other words, we don't compare one company to another. We compare each company against its past efforts, and then sum it up with an overall grade.

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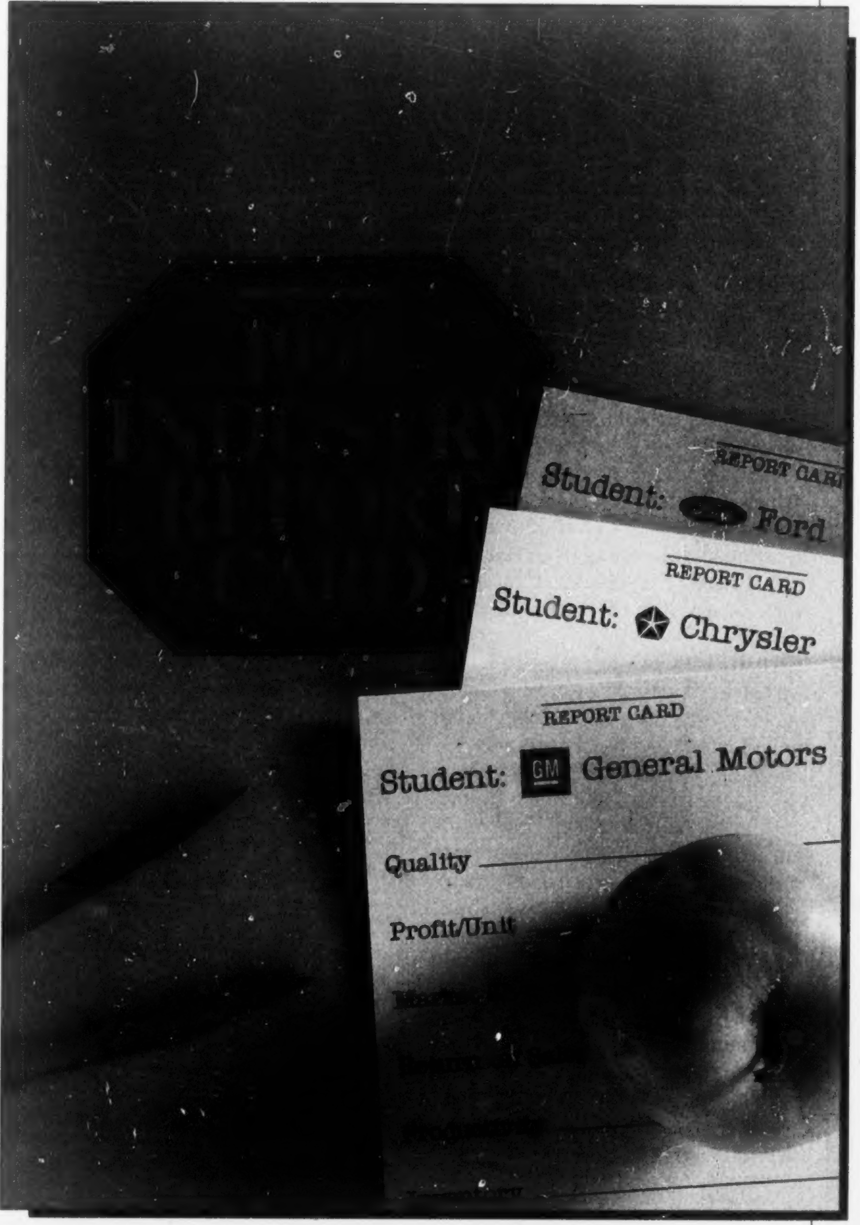


INDUSTRY REPORT CARD

At Ford, new products equal more efficiency.

FORD MOTOR COMPANY

Quality: Ford has had its ups and downs in the last three years. But the latest report, which is based on J.D. Power's Initial Quality Survey, shows the company is building cars with far fewer defects per 100 vehicles.

We've noted before that Ford's slowdown in the Quality category was probably due to the high level of overtime the company was using in the last few years. In 1989 the company reduced its overtime, and its quality improved dramatically.

Profit/Unit: It's surprising to see how far Ford's profit per unit dropped last year. Obviously, a lot of this had to do with the fact that the company relied on heavy marketing costs to keep its vehicles selling well in the American market. But even the company's vaunted overseas operations were not immune from the downturn. Overseas profits were off 3% at $2.1 billion, dragged down almost entirely by Ford of Europe – despite record vehicle sales there. This was due in part to Ford of Europe's higher new-product development costs on the Fiesta and CDW-27 (Tempo, Sierra), and labor problems in England.

Market Share: This is an area where Ford did very well. Even though the company's sales actually fell, they fell a lot less than the rest of the market did, which allowed it to increase market share. Not only are Ford's cars and trucks well received by American consumers, the company stepped in and applied incentives to make sure the products kept moving. For all the talk of the short-term outlook of American automakers (much of it deserved), they certainly do keep a keen eye on their share. And that's a sign of long-term thinking.

Having said that, however, the best selling car in the United States last year wasn't the Escort or the Taurus, it was the – gulp – Honda Accord! And what Honda gets, it doesn't give up easily. Even so, we expect a big push from the new Escort to reclaim the top spot.

Return On Sales: From a financial standpoint, Ford slipped a lot in 1989. Automotive profits were down $1.4 billion, and almost all of that dropoff came from the US. About $424 million of the US loss came from selling off Rouge Steel at below book value, while the rest is accounted for by a decline in sales, higher marketing costs (rebates), and higher new-product development costs.

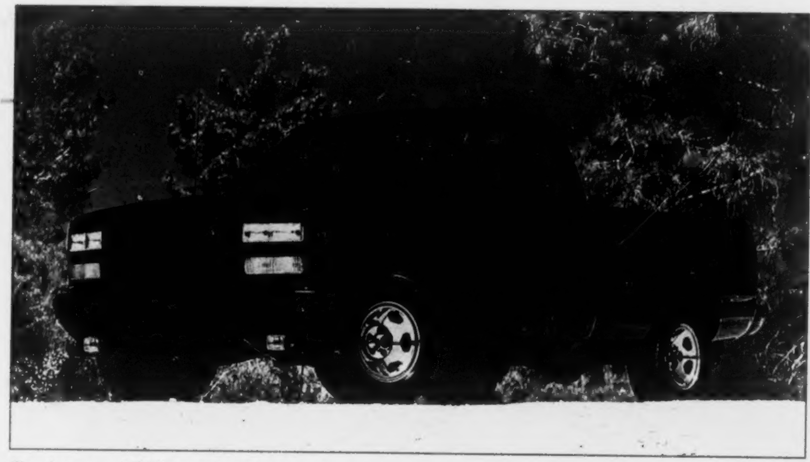
Simply put, the company's problems stem from one simple fact: Total automotive sales increased only $686 million dollars, while the cost of sales rose by nearly $2.4 billion. It seems safe to predict that Ford chairman Red Poling will attack these costs with a vengeance.

Productivity: Even though it built fewer vehicles worldwide last year, Ford managed to increase its productivity. That performance is all the more impressive considering that Ford also cut way back on overtime in its North American facilities. This shows that the company is maintaining its goal of improving productivity with each new vehicle it introduces – a process that starts in the earliest stages of design.

Inventory Turns: Despite a downturn in sales, Ford was able to improve its inventory turns. This is impressive, because a sales downturn makes it more difficult to balance production schedules, which in turn tends to drive up inventory levels. By improving its turns in a down market, Ford shows that it is managing its manufacturing operations well – a fact corroborated by its improvement in quality and productivity.

FORD MOTOR CO.

CATEGORY	1973	1978	1987	1988	1989	GRADE
Quality *(defects/100)*	--	--	156	169	143	B
Profit/Unit	$260	$360	$1023	$1014	$663	D
Market Share	29.8%	26.5%	23.1	23.7%	24.6%	A
Return On Sales	3.9%	3.7%	6.4	5.7%	3.9%	D–
Productivity *(cars/man/yr.)*	13.7	13.8	18.7	19.9	20.9	A
Inventory Turns	5.3	6.5	15.6	17.3	18.0	A
					OVERALL GRADE:	B–



Trucks saved GM's market share last year.

GENERAL MOTORS CORP.

Quality: This is one area where GM is coming on strong. But it's Buick, Olds and Cadillac – in that order – which deserve all the credit. Buick has been especially impressive. It now ranks seventh overall in the US marketplace and only has one (1) more defect per 100 cars than does Acura. Olds is tied with Lincoln, and Cadillac is well ahead of BMW.

At the other end of the spectrum are Chevrolet and Pontiac, which don't even make the top 20 – a problem that should be setting off "Red Alert" warnings at C-P-C.

B-O-C will be introducing a slew of new cars in the next three years, and we expect the group's quality ratings will go higher still. The reason is that these vehicles will be designed with far more ease-of-manufacturing than current models.

Profit/Unit: GM slipped in this area, but not nearly as badly as might have been expected, and certainly not as badly as Ford. This is due to the company's extremely profitable overseas operations, particularly those in Europe, which netted $1.8 billion in profits. In fact, GM earned $1143 per unit sold in Europe.

It was largely the high cost of marketing (meaning rebates) in North America that dragged down GM's overall profitability. This poses a question for the future: What happens to GM's profitability if EC92 turns into a price war and rebates become a widespread marketing tool in Europe, too?

Market Share: Not many people seem to have caught on to the fact that GM is gaining US market share. But it's GM's truck sales that are saving the company. GM's truck sales fell only 1% last year, compared to 2.8% for the total US truck market.

On the passenger car side of the ledger, GM sales dropped by 385,000 units, which was equal to one full market share point. One would think that GM's positive quality rating would have prevented such a drop off. Since it didn't, this strongly suggests that GM continued to do an ineffective job of marketing its products – except for Cadillac and Buick, which increased their penetration.

Return On Sales: GM was pleased to announce that it had outearned Ford for the first time in several years. But that was mainly because Ford had bigger financial problems than GM. The Number One automaker not only suffered an overall drop in profitability, it suffered a drop in overall efficiency as reflected in its lower return on sales.

One has to wonder how much credence can be placed in GM's much vaunted Action Plan, which supposedly has cut costs by $11.5 billion since 1987. GM claims that $3 billion of those savings were achieved last year alone. On top of that, its overall 1989 sales increased by more than $3 billion. This would suggest a $6 billion turnaround. Yet, the company's profits actually fell. It seems that the Action Plan must be made up of cost avoidances, rather than actual improvements in efficiency.

Productivity: GM is going nowhere in this category, as the total historical trendline demonstrates all too clearly. In fact, last year GM fell behind, while Ford and Chrysler surged ahead. This shows that GM is still operating with too much overcapacity – especially in North America. Unfortunately, this probably foretells a big battle this fall between GM and the UAW as the company strives to streamline its operations and the union fights to save jobs.

Inventory Turns: This is a category in which GM scored as impressively as it did in Quality. And there is a direct correlation between the two. With less inventory lying around, quality defects come to the surface more quickly.

Though the Productivity category shows that the company wasn't able to build more vehicles with fewer people, at least the Inventory Turns category shows that GM used its manufacturing facilities more efficiently. It did an outstanding job of building what was needed, when it was needed and in the needed quantities.

Continued on p. 32

GENERAL MOTORS CORP.

CATEGORY	1973	1978	1987	1988	1989	GRADE
Quality *(defects/100)*	--	--	176	165	158	A+
Profit/Unit	$490	$684	$435	$692	$645	C
Market Share	51.5%	47.3%	34.7	34.9%	35.0%	B+
Return On Sales	6.7%	5.5%	3.5%	4.4%	3.8%	C
Productivity *(cars/man/yr.)*	11.4	12.1	11.3	12.9	12.6	C
Inventory Turns	5.4	6.7	18.0	18.8	20.0	A+
					OVERALL GRADE:	B–

INDUSTRY REPORT CARD

Chrysler's rebates hurt profits.

CHRYSLER CORP.

Quality: Chrysler's quality rating has been sort of up and down in the last three years. In 1989 the company made a tremendous improvement, but it still lags behind GM and Ford.

Unfortunately, Chrysler is in something of a "catch-22" situation. Since it only has one platform, it can easily make quality improvements across the board. But at the same time, it has to wait for a new platform before it can incorporate new designs and technology that can further boost quality – and that means every carline suffers in the interim. In this regard, the company will be held back until the new LH platform arrives for the 1993 model year. Nonetheless, as the 1989 quality category demonstrates, Chrysler has been able to cut down on the number of defects per 100 cars it builds.

Profit/Unit: Obviously, you can't become The Rebate Company and expect your profitability to remain high. Not only did Chrysler continue its aggressive rebate program throughout 1989, by the end of the year the company was rebating its massively profitable minivans and Jeeps. That hurt the bottom line. And will consumers expect anything less than a rebate on the minivans and Jeeps again?

Market Share: This is a category in which Chrysler could be on a long, slippery downhill slide. Despite the fact that the company unleashed a barrage of marketing gimmicks, it was not able to hold onto its share of the market.

Like GM, it was Chrysler's truck operations that prevented a bad situation from getting worse. The company's car sales were off 171,600 units (14.4%), while trucks fell by 32,400 units (3.1%).

Return On Sales: This is another area where Chrysler fell badly. On the one hand, the company was bouyed by selling 75 million shares in Mitsubishi Motors Corporation, which boosted its bottom line by $300 million. On the other hand, by writing down several operations, with the unemployment benefits and pensions costs such actions bring, the bottom line was reduced by $577 million.

Since Chrysler chairman Lee Iacocca has stated the company needs to close more operations, this doesn't bode well for next year. But *on the other hand*, Chrysler sold Gulfstream Aerospace in February 1990 for a $183 million profit. Its Electrospace Systems and Chrysler Technologies Airborne Systems are on the auction block, too.

Productivity: Chrysler's manufacturing operations are turning into a competitive asset for the company. Last year, it turned in a solid 8% improvement, despite the fact that sales went down.

And the year before, when sales were up, Chrysler boosted its productivity by 11%. This rate of improvement is better than what Ford achieved in the last two years, and shows that Chrysler is starting to hit its stride in manufacturing efficiency.

Inventory Turns: This is a category in which Chrysler turned in a spectacular performance. By carefully controlling its manufacturing operations, it was able to eliminate a lot of waste in the system. And this confirms that the company's good showing in the Quality and Productivity categories was no fluke.

If Chrysler can keep up this rate of improvement, by the middle of the decade it could be up there with the best of the Japanese in this category.

CHRYSLER CORP.

CATEGORY	1973	1978	1987	1988	1989	GRADE
Quality *(defects/100)*	--	--	178	202	169	B
Profit/Unit	$127	($129)	$853	$649	$249	D--
Market Share	15.6%	11.2%	12.3%	13.9%	13.7%	C–
Return On Sales	2.1%	(1.5%)	4.5%	3.0%	1.0%	F
Productivity *(cars/man/yr.)*	13.0	13.1	16.2	18.0	19.5	A
Inventory Turns	5.6	6.3	16.8	21.6	26.3	A+
( ) = negative number					OVERALL GRADE:	C+

PRODUCTIVITY VS. PROFIT SHARING

How to get more efficient – and why the union is worried.

by BRUCE BEIER
and MARY GEARHART

This article, based on findings from *The Harbour Report*, analyzes labor productivity and its relationship to profit sharing. But why focus on labor, in this age of automation, when most people believe that labor is only a fraction of the cost of goods?

Well, that's not exactly right. While it is true that direct labor is estimated to be about 10% of total costs, the total cost of all labor – that is wages and benefits for all direct, indirect, and salary manpower – is estimated to be as high as 25%.

Over the past 10 years, each of the Big Three has taken different approaches to improving operations, which has had various effects on labor productivity. The chart (below left) illustrates Big Three labor productivity improvements in four key areas: assembly, stamping, engines and transmissions.

Labor Productivity Improvement 1979 to 1989

	Assembly	Stamping	Engines	Trans.
Chrysler	19%	30%	9%	N.A.
Ford	31%	45%	43%	45%
GM	5%	14%	-13%	-2%

Source: *The Harbour Report: A Decade Later*

As you can see, Ford has made substantial improvements in labor productivity – much more so than Chrysler or GM. But what does this mean? Just because they've improved more, it doesn't mean they're better, does it? Maybe they were less productive to begin with! Let's use vehicle assembly to see if this is the case.

Vehicle Assembly Labor Productivity (Workers Per Unit Per Day*)

	1979	1989	Improvement
Chrysler	5.63	4.58	19%
Ford	4.71	3.25	31%
GM	5.12	4.88	5%

*Workers per unit per day calculated using daily production & total assembly employees for the company (hourly & salary).

Source: *The Harbour Report: A Decade Later*

Obviously, Ford not only made sub-

Continued on p. 55

Asia Series

On your day off, you'll find Seoul has many interesting features.

Seoul is known as a great place for bargains, and Itaewon is one of the best places to find them. Seoul also has many other attractions. Walking tours and trips outside the city provide a look at Korean culture. So, if you're there on business, take time to see Seoul at more than face value.

Zone out.

At the 38th Parallel lies the Demilitarized Zone (DMZ). Once there, you can visit Panmunjom, site of the armistice that ended the Korean War. Don't miss the 240-foot-deep tunnel, cut into bedrock, that heads toward Seoul. For a full-day tour phone the Korea Travel Bureau (tel. 2-585-1191) two days before you want to go.

Visit the folks.

The Korean Folk Village, just outside Seoul, is a living museum in which potters, weavers, millers, blacksmiths and other craftsmen recreate the lifestyles of times past. The major hotels have information about day trips.

Standing tall.

Rising high above Seoul's skyline is the Daehan Life Insurance Building, or "Golden Tower," the tallest building in Asia. From its observation deck on the 60th floor you can see as far as North Korea. There are a variety of restaurants here too. For more information, call 789-5663/50.

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NORTHWEST AIRLINES

Impact of Labor Productivity on Vehicle Cost 1989

Process	Ford	Chrysler	GM
Vehicle Assembly Labor Cost/Vehicle	$780	$1121	$1171
Body Stamping Labor Cost/Car Set	$259	$336	$384
Engines Labor Cost/Engine	$175	$245	$233
Transmissions Labor Cost/Transmission	$173	$163	$228
Ttl. Labor Cost/Vehicle (excluding components)	$1387	$1865	$2016
Cost Over Base/Vehicle	N.A.	$478	$629
Annual Penalty (Billions)	N.A.	$1.6	$3.65

Based on a labor rate of $30/hour

Source: *The Harbour Report: A Decade Later*

PRODUCTIVITY

Continued from p. 53

stantial improvements, it is also significantly more productive than Chrysler or General Motors.

Well, so what? What does this have to do with profit sharing? We're getting to that. But first you need to know what effect labor productivity has on costs. (And boy, does labor productivity affect costs!) (See chart above.)

It doesn't take a rocket scientist to figure out that these cost penalties to Chrysler and General Motors translate directly into lost company profits. And what do lost company profits translate into? You guessed it: low or no employee profit sharing!

Profit Sharing at The Big Three

	GM	Ford	Chrysler
1984	$643	$400	$0
1985	$543	$2000	$0
1986	$347	$1200	$0
1987	$0	$2100	$0*
1988	$0	$3000	$0*
1989	$254	$2800	$720
1990	$50	$1025	$0
TOTAL	$1837	$13,255	$720

Paid in year indicated based on corporate profits from the previous year.

*Contractual payouts, not tied to profits, were $500 for '87 and '88.

Source: *The Detroit Free Press*

The chart (below left) shows profit sharing payouts for each of the Big Three since 1984, when they were introduced into the national agreements. Chrysler did not have a profit-sharing agreement until 1987, when it agreed to employee bonuses of $500 for 1987 and 1988. The GM payout for 1990 is a contractual minimum.

If you refer back to the chart showing productivity improvements for the Big Three, you can see that there is definitely a correlation between labor productivity and profit sharing.

Now that we've established the relationship between labor productivity and profit sharing, maybe we should back up a little and explain exactly what we mean by labor productivity. What makes one company more productive than another?

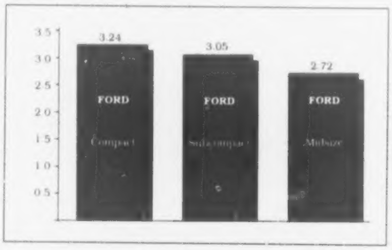
Productivity is, by definition, what you get out of a system (output) divided by what you put into a system (input). In this case, the output is whatever is produced (cars, engines, etc.). The input is everything it takes to make the output (materials, labor, energy, etc.). Specifically, labor productivity is just what it sounds like – the amount of units of output divided by the number of people used to produce them. In our report, we have inverted the ratio of units per worker to obtain the number of workers it takes to produce one unit of output.

To improve productivity, one of three things must happen. You must increase output with the same number of employees, reduce the number of employees with the same amount of output, or increase output and reduce the number of employees. But increasing labor productivity is not merely the result of cranking up the line speed (although there are plenty of managers who have tried to use this method).

The difference in productivity between plants and companies, contrary to popular belief, is not because workers goof off in one plant, while workers in another plant rush around at a breakneck pace to keep up with the production line. It may be true that some people just work "harder" than others, but this is not the main reason for productivity differences from plant to plant. There are many other factors that cause these differences.

Before we discuss these factors, we need to clarify some common misconceptions – two to be specific.

The first one has to do with the size of the car. Many people believe that if you are comparing the productivity of two plants, the plant that makes the larger car will automatically be less productive, purely because of the car's size. But our research shows that this is not the case. While it is true that vehicle content affects assembly productivity, vehicle size alone does not account for the differences in productivity. The following chart, showing workers per car and car size, illustrates this point.



Another common misconception is that the sourcing differences between companies and plants account for a significant portion of the productivity difference. While it is true that sourcing affects productivity levels, the question is, "By how much?"

We examined some typical Big Three assembly plants to try to determine the answer to that question. As the

Continued on p. 56

Typical Assembly Plant Sourcing Differences

	GM Doraville (Olds Cutlass)	Ford Atlanta (Taurus/Sable)	Chrysler Newark (Acclaim/Spirit)
Bumper Assembly	YES	NO	YES
Seat Buildup	YES	YES	NO
Fixture Const/Repair	YES	NO	YES
Rail Car Loading	NO	YES	NO

Source: *Harbour and Associates, Inc.*

Typical Assembly Plant Labor Productivity Adjusted for Sourcing

Plant	Actual Workers/Unit	Adjusted Workers/Unit
Chrysler Newark	4.36	4.65
Ford Atlanta	2.72	2.77
GM Doraville	5.50	5.55

Source: *Harbour and Associates, Inc.*

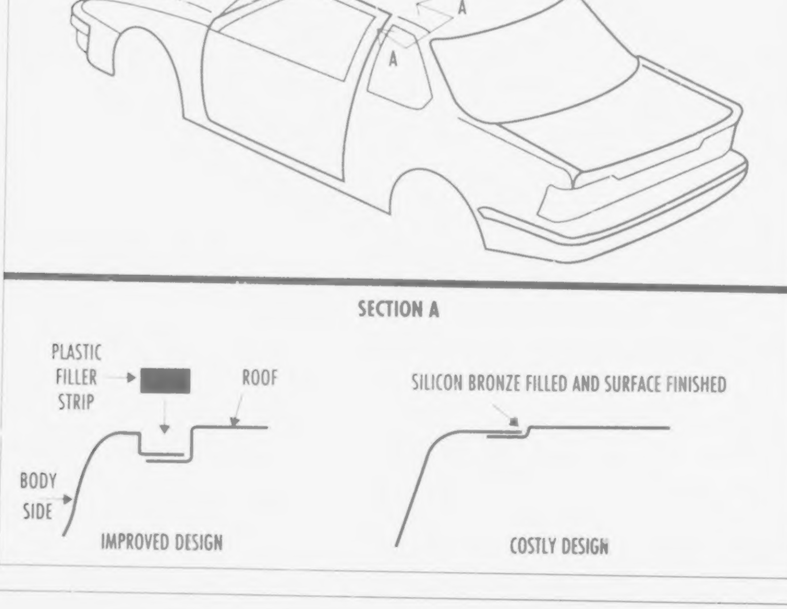
PRODUCTIVITY

Continued from p. 55

two charts above illustrate, not only were there few differences in the level of sourcing, the difference between plants in terms of workers per unit was the same or larger after adjustments for sourcing.

Now that the misconceptions have been clarified, let's talk about the factors that make one company more productive than another. As we said, there are several. One of them is design for manufacturing and assembly (*DFMA*, see March '90 *AI*, p. 34).

The illustration below shows an improvement in the roof to body side joint design. The design of the lap joint allows extremely tight tolerances to be maintained on critical body dimensions regardless of variations in the body stampings. By replacing the operations of silicon bronze and body finishing with the plastic filler strip, approximately 30 fewer workers are needed. By itself, this design change does not account for huge productivity differences, but imagine what hundreds of similar design changes will do.



Another area which affects labor productivity is worker utilization. You may argue that we said the difference wasn't because people in one plant work harder than people in another, so how can we now say that a major factor is worker utilization?

There are two parts to the definition of worker utilization. Part one is the number of minutes per hour a person works. Part two is the amount of the time spent working which is value added. Minutes worked per hour is affected by process engineering and line balancing. If only $^2/_3$ of the cars coming down the line need the parts being installed, then $^1/_3$ of the time is being wasted. Similarly, value added time is also affected by process engineering. If of the $^2/_3$ of an hour an employee is working, he spends half of that time walking or looking for tools, then he's only installing parts (adding value) a net of $^1/_3$ of the time.

Workplace engineering is another factor affecting productivity that is also related to worker utilization. This includes plant and workstation layout, containerization suited to specific parts and tasks, elimination of off-line subassembly operations, as well as other techniques.

Quality is yet another area affecting productivity. Good quality, built into a product the first time, requires significantly fewer people than producing parts that require 100% inspection, sorting and repair work. Many companies have already proven that quality and productivity are complimentary rather than contrary.

So, what is the gist of all this talk about productivity? Improvements in productivity have a direct impact on how many jobs are needed. While many of the productivity-improvement factors cited here are management's responsibility to address, there is no question that the union leadership will have to be involved.

Eventually the union will have to decide whether or not to swallow the politically bitter pill of reduced membership. If it decides against this, then it runs the risk of sacrificing both profit sharing and job security. AI

Ag Equipment Sales Ripen

JOHN STARK is editor and publisher of Stark's Off-Highway Ledger in Chicago, IL.

The North American farm machinery business is in the midst of a rebound, the extent of which will be gauged at the end of the spring planting selling season.

Farm acreage plantings are on the rise. Farm asset values are climbing. Debt loads are falling, and net cash income is on the mend as prices for harvested crops continue to improve.

For US and Canadian manufacturers of farm tractors and self-propelled combines, assembly plant output has risen for nearly 24 straight months. It follows an end to steep vehicle price discounting and widespread depletion of good used tractor and combine stocks on dealer lots.

In 1989, retail demand for all vehicles ended nine consecutive years of decline, as unit turnover rose by 2%.

More significantly, producer use of existing farm assembly plant capacity surged to a seven-year high throughout North America in 1989, as tractor and combine assembly rebounded for the third straight year.

Farm machinery manufacturers produced 51,630 units in 1989, a 22% increase from 42,385 vehicles in 1988. It was the highest level of annual output since 1984, when 71,390 units were built.

High-horsepower tractor and combine sales in the US and Canada rose by 34% in 1989, to 39,895 from 29,715 units in 1988. Yet, vehicle assembly outstripped annual sales, a clear sign that manufacturers continued to rebuild dealer inventories for the second straight year.

It indicates that farm machinery producers are rebuilding stocks at dealer outlets, in anticipation of a major rebound in farm vehicle sales this year.

Farm machinery producers are anticipating a major rebound in farm vehicle sales this year.

John Deere expanded its position as the leading volume-maker of tractors and combines in 1989. Although its share of unit assembly slipped to 50.5% in 1989 from 52.5% in 1988, vehicle volume expanded to its highest level since 1983 – a 17% rise to over 1988.

J.I. Case ranked second at 32% versus 30.5% in 1988. It was Case's highest level of production since 1985. Ford New Holland was third at 8%, unchanged from 1988. White-New Idea Farm Equipment built the fourth highest volume of vehicles, with 6% of industrywide unit output, up from 4.5% in 1988. Deutz-Allis was fifth and Caterpillar, a marker of large four-wheel-drive tractors, was sixth. Massey Combines fell into receivership and was liquidated.

A closer look at overall industrywide production activity shows that farm tractor assembly increased by 17% in 1989, to 39,115 from 33,395 vehicles in the previous year. Combine production rose by 39% to 12,515 from 8990 as manufacturers raised daily assembly schedules in the wake of a major market upturn during late 1989.

In 1990, North American sales of tractors and combines are seen advancing by another 7%. It could lead to an additional 25% rise in unit vehicle output – to 64,500 machines.

While 1990 vehicle assembly is still seen below the 1984 level of 71,390, the longer-term trend points toward a more substantial recovery in 1991 – capping a five-year rebound in the current business cycle.■

North American Farm Machinery Production, 1983-1989

	1989	1988	1987	1986	1985	1984	1983
Deere	26,045	22,230	15,630	5260	13,250	20,415	28,480
Case	16,515	12,945	9925	9200	17,125	17,315	18,010
Ford	4115	3455	5590	10,430	14,285	20,775	21,720
White	3000	1830	2575	1475	345	2335	1250
Deutz	1370	1460	1645	1240	3035	8500	7815
Caterpillar	585	465	385		...	...	...
Massey	---	---	1390	750	1675	2050	1620
Total	51,630	42,385	37,140	28,355	49,715	71,390	78,895

Note: Acquired and merged farm machinery companies' results combined to display true pattern of year-to-year change in farm tractor and self-propelled combine assembly activity in the US and Canada.

TOHI
TRUCK & OFF-HIGHWAY INDUSTRIES

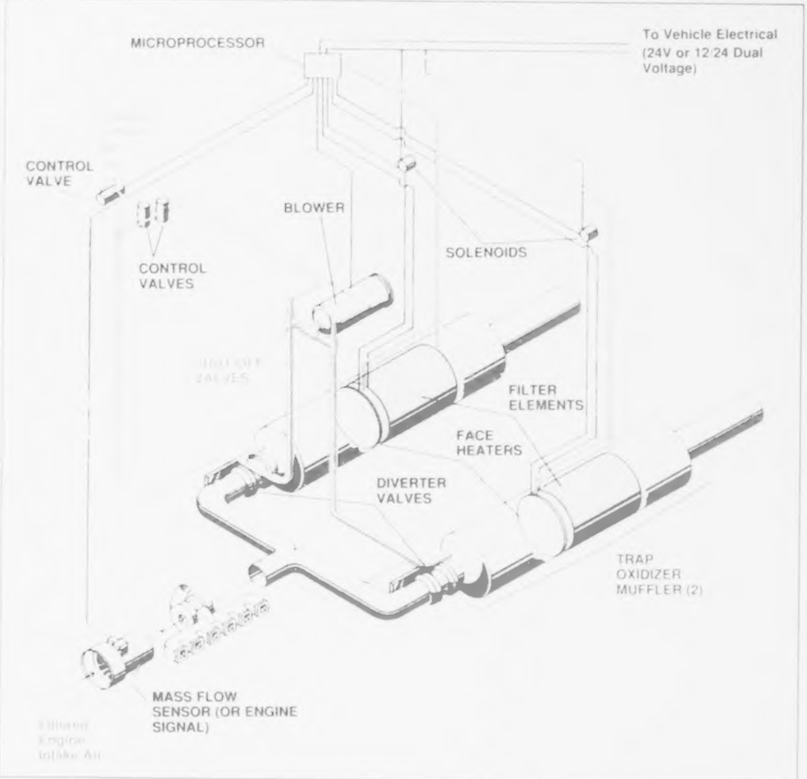
THE 'WALL' COMES DOWN

How are America's dieselmakers meeting the 1991 and 1994 EPA regs?

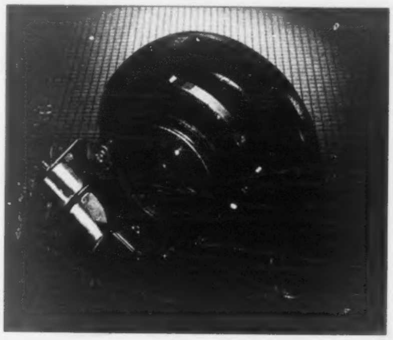
by LINDSAY BROOKE

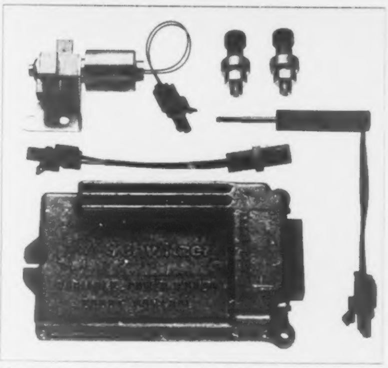
Just four years ago, many US diesel engine makers saw the EPA's increasingly stringent emissions regs as a 'wall' that couldn't be scaled. At that time, some felt the upcoming 1988 particulate (PM) standard of .6 grams per horsepower hour (g/hp-r) might even spell the end of the diesel engine. Technology, lots of dyno hours and thousands of test fleet miles proved them wrong.

The 1991 NOx and PM regs have upped the ante again – and the ultra-clean '94 PM standards (see chart) have many diesel engineers worried. Some current engines may be discontinued by '94, while others will need extensive modification to meet the new regs.


MICROPROCESSOR
To Vehicle Electrical (24V or 12/24 Dual Voltage)
CONTROL VALVE
BLOWER
CONTROL VALVES
SOLENOIDS
SHUT OFF VALVES
FILTER ELEMENTS
FACE HEATERS
DIVERTER VALVES
TRAP OXIDIZER MUFFLER (2)
MASS FLOW SENSOR (OR ENGINE SIGNAL)
Filtered Engine Intake Air

Donaldson Co.'s particulate trap is being tested on 400 Detroit Diesel-powered New York buses. In this system, called bypass regeneration, core is heated (burning soot inside), while exhaust flow is bypassed either to muffler or to another trap system. Donaldson is experimenting with both electricity and diesel fuel to heat the burner.





Variable-geometry turbochargers may be common on truck diesels by '94, yielding lower emissions through improved boost control over the rpm range and better fuel economy. Mack has tried new Schwitzer VPT (Variable Power Turbo). Turbo vane control is by Schwitzer ECU. Garrett's new VNT (not shown) is in production on Nissan heavy diesels.

How are America's major dieselmakers facing these challenges? Here's what's coming in '91, with an update on the industry's progress towards 1994.

1994: WHAT'S COMING?

Low Sulfur Fuel

Diesel manufacturers have lobbied the EPA hard for cleaner diesel fuel containing a maximum sulfur content of .05%. Current diesel fuel sulfur levels are near .3%, and since roughly 33% of PM emissions are byproducts of fuel sulfur, this will be an important step.

Although low-sulfur fuel will not allow engines to reach the .1 g hp-r PM level, it's crucial to aftertreatment systems. Catalytic converters depend on clean fuels; without them, sulfates (solids) in the exhaust are formed which can't be oxydized in the catalyst.

The diesel industry would like the new fuels mandated and available from all US refineries by 1991. It's likely that will happen by '93 instead, even though the EPA intends to allow '91 diesel emission certifications using the new fuels. Currently, the EPA is talking about granting exemptions to small refiners who have complained about the plan's cost and timetable. Some chief engineers at the diesel companies say this is just another way for the oil industry to duck the issue.

Aftertreatment

Whether dieselmakers jump on the exhaust aftertreatment bandwagon *as an industry* is the $64,000 question. Generally, engineers are encouraged by the progress they're making with this technology. It's now on test by all the players, but nobody's talking about which type of system they're favoring – regenerative soot traps with or without catalytics (some using expensive noble metals), electrically-heated types, or those heated using diesel fuel are the leading candidates.

Concerns continue about clogging

Continued on p. T-8

EPA Medium- And Heavy-Duty Diesel Emissions Regs (g/hp-r)

	CO	HC	NOx	PM
1990	15.5	1.3	6.0	60
1991	15.5	1.3	5.0	25
1994	15.5	1.3	5.0	10

DIESEL EMISSIONS 1991:

Who's	Doing What?
EPA	Allowing each dieselmaker emissions averaging, emissions credit trading and credit banking, and payment of non-conformance penalties. This way, newer, cleaner engines can help older products survive – at least until 1994
CATERPILLAR	Raising injection, cylinder pressures Low-inertia turbos on 3176, 3406 Tweaking injection nozzles, turbos and electronic fuel maps on PEEC Low-crevice volume (LCV) pistons on 3406 Raising horsepower in some ratings
CUMMINS	Raising injection pressures Adding new PCI electronically-controlled, unit injector (mid-'90) Improving piston, ring technology Offering CNG or methanol-fueled L10 Raising horsepower in some ratings
DETROIT DIESEL	Raising injection pressures on Series 60 and two-strokes Higher top-ring pistons on Series 60 Tweaking cam profiles, valve event, turbos, compression ratios Electronic engine controls (DDEC) standard on 71- and 92-series two-strokes Offering methanol-fueled 6-71 and 6V-92 Raising horsepower in some ratings
FORD	Raising injection pressures, comp. ratios Tweaking injection timing, fuel delivery profiles, rated rpm New pistons with re-entrant chambers No electronic controls for '91 Adding new 215-hp/2000 rpm rating
MACK	Adding electronic engine management (VMAC) to E7 range, mid-'90 Raising injection pressures Tweaking injector nozzles Higher top-ring pistons Possible air-to-air intercooling and variable-geometry turbo Adding highest E7 horsepower rating: 425-hp
NAVISTAR	Raising injection pressures, other changes per progress on 1994 'smokeless' engine

H-D DIESEL EMISSIONS

with soot, wear metals and compounds that can't be oxydized. Increased backpressure, and its effect on engine performance, also presents a challenge.

Navistar is using a flow-through catalyst system on its 'Smokeless 94' diesel introduced late last summer. With the engine, based on the company's DT466 (see October '89 T&OHI, p. T-6), Navistar claims it can beat the '94 PM standards. Navistar has yet to prove the converters' total durability at the legally required 150,000 mile mark. And some diesel engineers claim that's not enough anyway.

"Navistar's done a great PR job on that engine," says Dave Merrion, senior VP, engineering, at Detroit Diesel. "Manufacturers need to certify their engines for the useful life—and for heavy-duty diesels, that's 290,000 miles. Some of the technology's there now, and some of it isn't."

How To Aftercool?

There is some speculation that the '94 diesel regs will spell the end of non-air-to-air aftercooling systems. Aftercooling affects the conversion efficiency of aftertreatment devices. Word from within the supplier community has Cummins opting for air-to-air over its current air-to-water system. One reason for such a change, if it happens, might be because with the change in the particulate standard, there have also been proposals to lower NOx levels. Air-to-air aftercooling gives the coldest intake temperatures, which brings the NOx down.

It's a tricky battle, because as exhaust NOx is reduced, PM rises. If catalysts are indeed needed for '94, exhausts might have to run hotter, not cooler, during trap regeneration. Aftercooler bypass systems, like the one now being used by Volvo to avoid overcooling and to cut white smoke at idle, might be another solution.

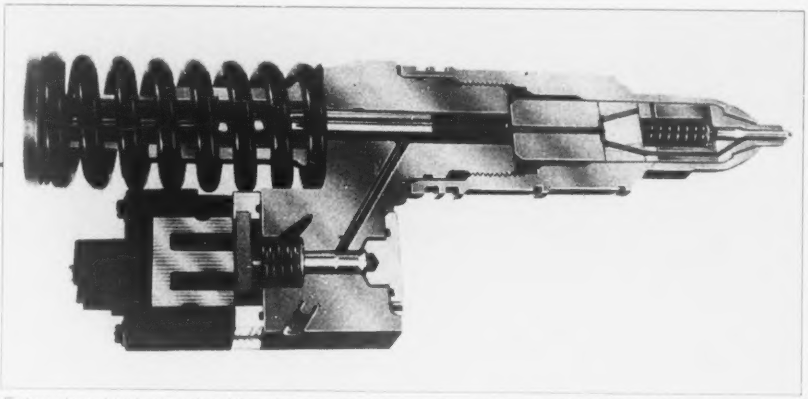
Two-Stroke Survival

Detroit Diesel's long-lived two-stroke range has evolved into a niche-market powerplant. It now utilizes the same electronic unit injector as the company's four-stroke Series 60, giving much improved HC and low-smoke emissions. Optional is DDC's DDEC electronic control package.

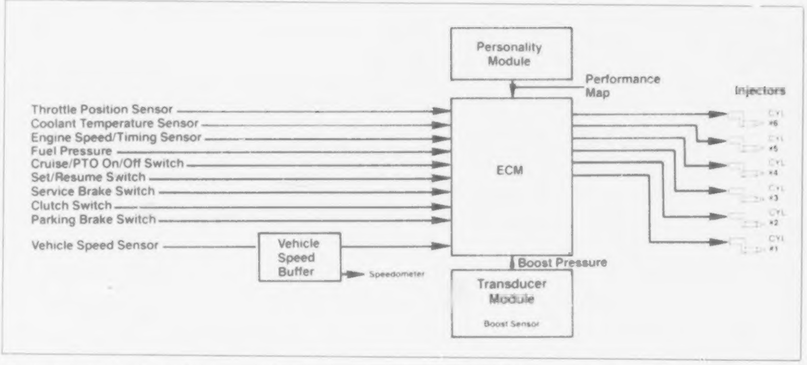
Can these refinements carry the strokers through '94? Yes, says Dave Merrion, if they can meet the transit bus emission standards for '91—which are the same as the '94 truck regs.

"Our thrust with the two-stroke is three-pronged: methanol fuel program; compressed natural gas (CNG) program (versions of which are now running on the test bench); and the particulate trap program," explains Merrion. The trap project, a venture with Donaldson Co., is being conducted on 400 New York City buses powered by 6V-92s and 6-71s.

Still, sales of urban bus diesels may dry up from '91 through '93, as the only current feasible alternative to aftertreatment is methanol, CNG or liquified petroleum gas (LPG). All of these come with their own attendant problems.



Entire diesel industry should embrace electronic unit injectors by '94. Detroit Diesel's (shown) is made by Penske-owned Diesel Technology Corp., is used on both Series 60 and two-stroke range.



Fully-integrated electronic controls, injectors help Cat 3176 meet '91 spec. Cat is basing its methanol program around 3406B series.

New Turbocharger Tech

Variable-geometry turbochargers, still in their infancy in automobiles, are also being introduced to big diesels to help meet the '94 crunch. Some, including Mack and Detroit Diesel, will feature these units before '94.

The advantage of these turbos is improved boost control. Connected to an electronic control unit, boost management is even more precise over a greater rpm range, reducing emissions while increasing throttle response, horsepower, torque and fuel economy. Schwitzer's new Variable Power Turbine (VPT), and Garrett's just-announced VNT45, feature movable vanes which change exhaust angle around the turbine. Both are also designed for electronic control.

The Garrett VNT45 is now in production on Nissan's 290-350-hp diesels sold in other markets.■

Paul Richards of Chilton's Commercial Carrier Journal magazine contributed to this article.

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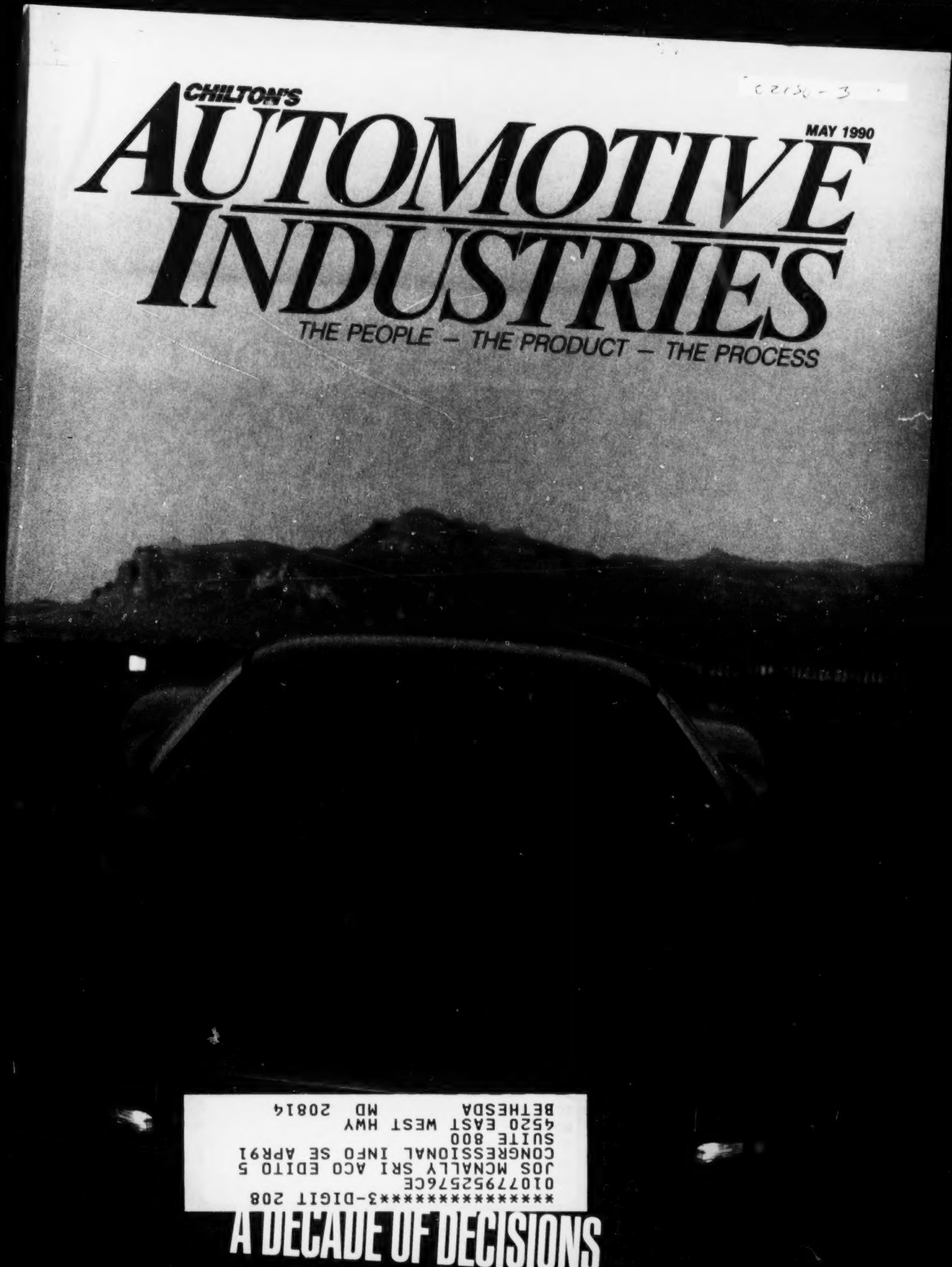
CHILTON'S

AUTOMOTIVE INDUSTRIES

THE PEOPLE – THE PRODUCT – THE PROCESS

MAY 1990



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A DECADE OF DECISIONS

Volume 170, No. 5 May 1990

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Letting machines do the thinking.

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Electronics pave the way for smart driving.

AUTOMAKER QUARTERLY REPORT

by DR. THOMAS O'GRADY

The downturn in automotive sales continued through the first quarter of 1990, although sales were not worse than 4Q '89.

Automakers planned cutbacks in North American production schedules during January and February, bringing needed reductions in bulging inventory levels during the quarter. Even output in the light truck market fell by 18.3% for the quarter.

Although its sales volume dropped, GM was able to reverse some of its recent decline in market share during the first quarter of 1990 with stronger sales in the Buick, Cadillac and Chevrolet divisions. GM made some substantial improvements since last year, and Bob Stempel's appointment as new chairman was stated as meaning further good news for long-term new product development and decentralization in marketing.

> *Domestic sales fell while imports enjoyed gains in both volume and share.*

Ford and Chrysler both reported steep declines in their passenger car volume for the first quarter of 1990; each lost about one and a half percentage points of share from 1989.

Among the importers, Toyota, Honda and Mitsubishi gained in both volume and share. With its luxury Lexus division in place and increased North American production capacity, Toyota seems to be gaining fast on Honda. After a successful 1989 rebound, Nissan seems to be faltering. Meanwhile, Mitsubishi's growth in the passenger car markets is accelerating rapidly.

Transplants marketed by both Asian and domestic automakers now capture 14% of the US passenger car market. And a surge in transplant light truck sales is right around the corner, beginning with Isuzu trucks built in Indiana and CAMI's Geo Traker/Suzuki Sidekick.

The Honda Accord (lengthened and restyled for 1990) retained its first place spot among carline sales for the quarter, this time with almost a 10,000-unit margin over the Ford Taurus. Three other transplants – the Toyota Camry, Corolla and the Honda Civic/CRX – also made the top ten.

Dr. Thomas O'Grady is president and chief analyst of Integrated Automotive Resources in Wayne, PA, and publisher of "Fast Track News."

WHAT'S HOT! Domestic Auto Sales 1st Quarter 1990

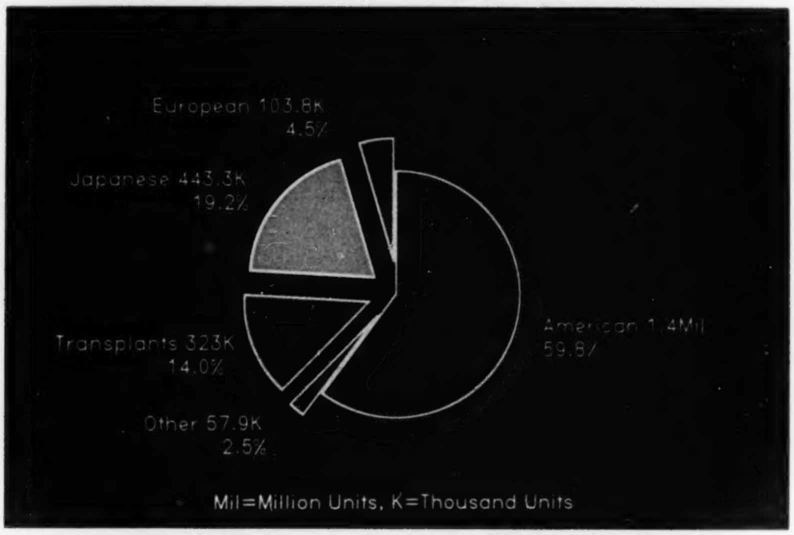
Carline	'90	'89	% Change
Accord*	94,308	72,254	30.52%
Taurus	84,372	83,275	1.32%
Corsica/ Beretta	80,018	86,767	-7.78%
Cavalier	77,009	72,862	5.69%
Escort	66,883	87,918	-23.93%
Camry*	66,110	47,641	38.77%
Tempo	62,006	59,783	3.72%
Lumina	57,389	---	---
Civic*	56,714	40,253	40.89%
Corolla*	55,299	43,373	27.50%

* – Includes imports

US Passenger Car Market Shares 1st Quarter, 1990

Manufacturer	'90 Sales	% Total	'89 Sales	% Total	% Change
General Motors	828,499	35.90%	829,986	35.49%	-0.18%
Ford	503,051	21.80%	546,068	23.35%	-7.88%
Chrysler	221,283	9.15%	247,953	10.60%	-14.79%
Honda/Acura	190,335	8.25%	163,512	6.99%	16.40%
Toyota/Lexus	186,756	8.09%	138,440	5.92%	34.90%
Nissan/Infiniti	110,145	4.77%	125,402	5.36%	-12.17%
Mazda	59,737	2.59%	54,120	2.31%	10.38%
Mitsubishi	46,129	2.00%	20,572	0.88%	124.23%
Hyundai	34,411	1.49%	49,691	2.12%	-30.75%
VW/Audi	33,336	1.44%	34,338	1.47%	-2.92%
TOTAL CARS	2,308,079	100%	2,338,480	100%	-1.30%

(Continued on p. 66)



Passenger Car Market Share By Geographic Base

First Quarter 1990

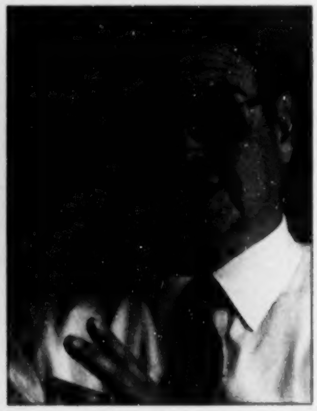
Manufacturers	Total Sales	Total Market Share
American	1,379,897	59.79%
Japanese	443,306	19.21%
European	103,841	4.50%
Transplants	323,148	14.00%
Other Imports	57,887	2.51%
Total	**2,308,079**	**100.00%**

1ST QUARTER 1990 DOMESTIC LIGHT TRUCK PRODUCTION*

COMPANY	FULL-SIZE TRUCKS	COMPACT TRUCKS	FULL-SIZE VANS	COMPACT VANS	FULL-SIZE SPORTS UTILITY	COMPACT SPORTS UTILITY	TOTAL 1Q '90	TOTAL 1Q '89
CHEVROLET	125,921[1]	54,972	23,839	50,252	25,554	34,661	315,199	397,571
FORD	148,419	75,179	44,783	44,991	13,701	22,727	349,800	464,804
GMC	40,698[1]	14,750	10,357	8,144	9,236	10,612	93,797	117,817
CHRYSLER	25,078	17,336	19,475	141,178	---	---	203,067	221,020
JEEP	---	2,001	---	---	1,300	56,408	59,709	93,571
NISSAN	---	38,784	---	---	---	---	38,784	35,030
PONTIAC	---	---	---	14,506	---	---	14,506	---
OLDS	---	---	---	7,550	---	---	7,550	---

[1] Includes Suburban and P-model. *Built in the US and Canada.

The Compact Decade



RAY WINDECKER's 45 years in the industry culminated at Ford, where he was research and analysis manager, public affairs. He now runs American Autodatum, an 'automotive numbers and words' company.

Compact trucks have yet to topple the full-size pickup from the top vehicle positon.

There were 14.845 million cars and trucks sold in calendar 1989, the final year of the 1980s, a gain of 3.381 million units from the opening year. Neither year – 1989 or 1980 – were record breakers, yet they followed somewhat similar sales patterns. 1980 trailed the then-record of 15.419 million set in 1978, while 1989 fell similarly short of the current 16.326 million record of 1986.

Neither year was a boom, neither a bust.

However, within the industry, there was considerable churning of consumer tastes, gasoline prices, product nameplates and new sheet metal, thus moving buyers from one market segment to another.

Compact cars and trucks were the obvious winners of the 1980s. Sales of compact cars grew to 2.700 million in 1989, 1.090 million more than bought when the decade dawned. Compact cars – Beretta, Camry, Tempo, Stanza and others – were both the volume and growth leaders of the decade, taking the sales volume crown from the gas-sipping subcompacts, with considerable assistance from the crude-oil producing nations.

The Taurus and Sable rejuvenated the mid-size sedan market. Yet, the mid-specialty and small sporty segments sagged, as buyers decided that many of today's low- and medium-priced sedans were sporty enough.

Trucks handily outgained cars, partly from the entry of volume-oriented compact van and compact utility lines and a continued surge in compact pickups, though compact pickups faltered a tad in 1989. Yet much of the virtual doubling of truck sales during the decade would be more accurately described as a recovery from the horrendous 40% drop in sales from 1978 to 1980.

Nevertheless, the consumer appetite for compact trucks is quite obvious. The three compact truck segments – vans, sport utilities and pickups – ended the decade with 2.185 million more sales a year than at the starting gun. For those of you wondering, Volkswagen provided the 1980 compact van sales as Ford, GM and Chrysler (which all sold compact vans in the 1960s), had not yet reentered the compact van market.

Compact trucks are a growth market, but they have yet to topple the full-size pickup from the top-truck position. The forever-popular large pickup segment not only leads within the truck market, two full-size pickups (the Ford F-Series and the Chevrolet CK-Series) outsell any vehicle, car or truck, and have for several years.

The performance of the luxury-car segment deserves a comment. In the late 1960s, luxury cars held 3.5% of the car market, in the late 1970s, 6.5% and in the late 1980s, 8.5%. As the "baby boomers" age, there would appear to be additional buyers moving into the luxury market. Let's hope so, as the list of luxury cars continues to expand.

Vehicle Segments
(units in millions)

	1989	1980	Change
Subcompact	2.043	2.399	(.356)
Small sporty	1.008	1.440	(.432)
Compact	2.700	1.610	1.090
Midsize	1.669	1.002	.667
Mid-specialty	579	984	(.405)
Large	912	1.002	(.090)
Luxury	.869	.510	.359
Car Types	9.780	8.947	.833
Large van	.452	.350	.102
Compact van	.844	.013	.831
Large utility	.111	.103	.008
Compact utility	.728	.055	.673
Truck wagon	.104	.038	.066
Large pickup	1.340	1.163	.177
Compact pickup	1.199	.518	.681
Medium & heavy	.287	.277	.010
Truck Types	5.065	2.517	2.548
TOTAL	14.845	11.464	3.381

( ) = negative number

Technical notes: In the above chart, a "truck wagon" is similar to a Chevrolet Suburban. The words "car types" and "truck types" in the chart can be interpreted as meaning that Japanese trucks that are reported as cars are segmented as trucks.

The sporty segment covers everything from a Bertone to a Ford Mustang GT. Mid-specialty includes Grand Prix, Thunderbird, LeBaron, etc. And, any one of these segments can be re-cut into sub segments. AJ

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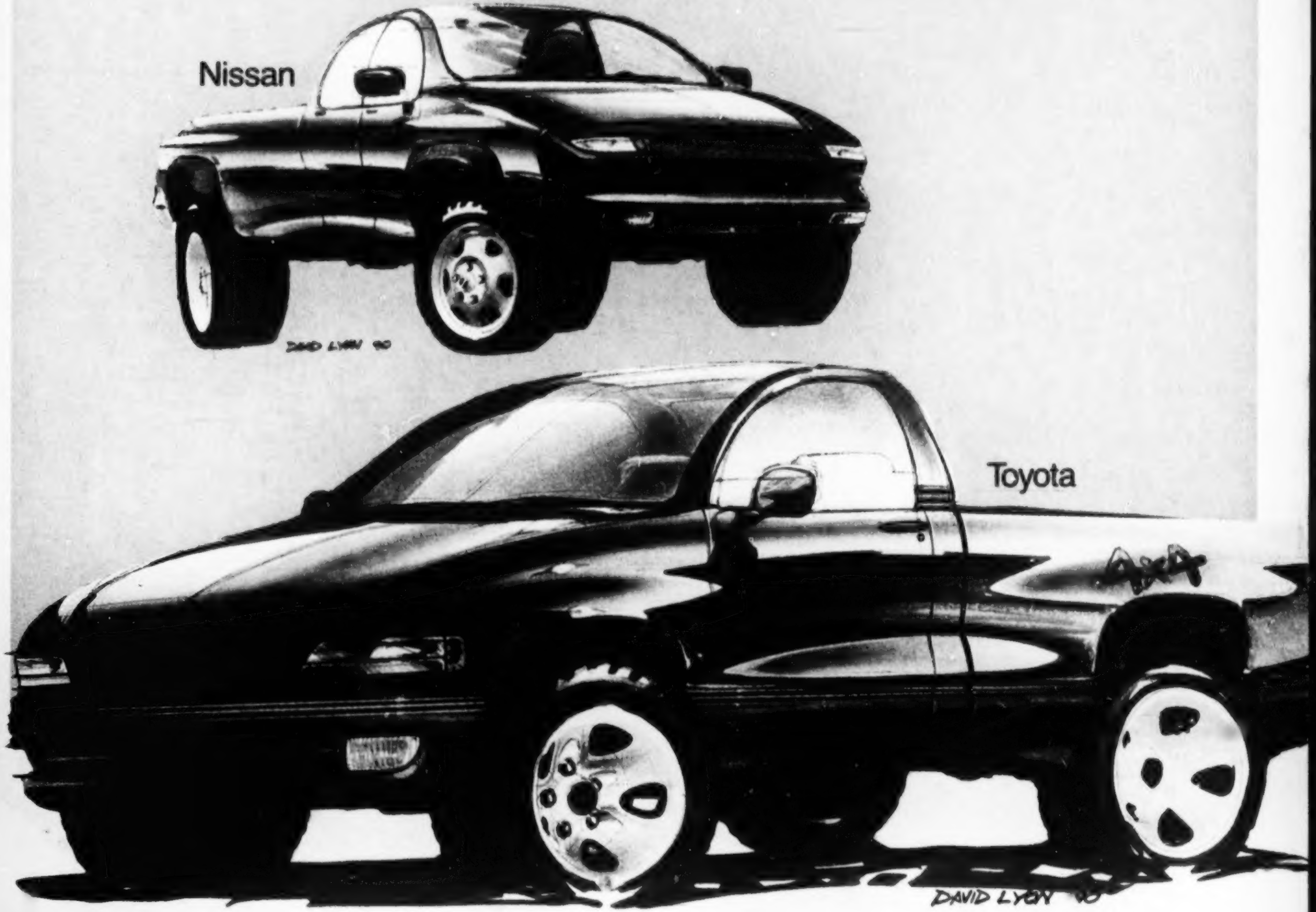
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Toyota
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Full-Size Pickups

HERE COMES JAPAN

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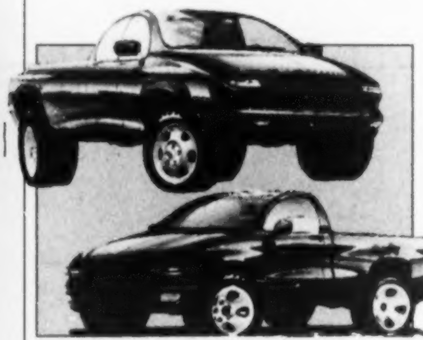

Future full-size Japanese pickups? See p. 28.

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(Not found in all issues.)

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When will the Feds mandate heavy truck ABS?

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FULL-SIZE PICKUPS

HERE COMES JAPAN!

by LINDSAY BROOKE

The Japanese are about to take on America's most popular vehicle. What will they think down in Texas?

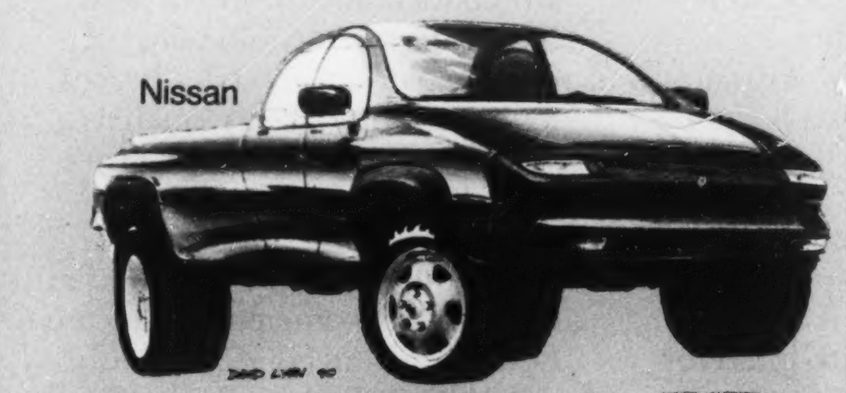
The full-size pickup truck, that most American of vehicles, is finally about to be challenged – by the Japanese, of course.

By 1995, at least one Japanese automaker, Toyota, will be fielding a mid- or full-size pickup – or pickups – in the US. Another maker, Isuzu, looks to be readying a full-size model as well (see sidebar). Their success will determine whether Nissan and the other Japanese companies join the fray. It will also influence the response of Ford, GM and Chrysler, who have a vested interest in keeping this highly lucrative market to themselves.

Two respected automotive analysts are certain such a move will occur, confirming what some Japanese product development officials have hinted since the late '80s. And both are sure Toyota will hit the beach first, in the 1992-93 timeframe.

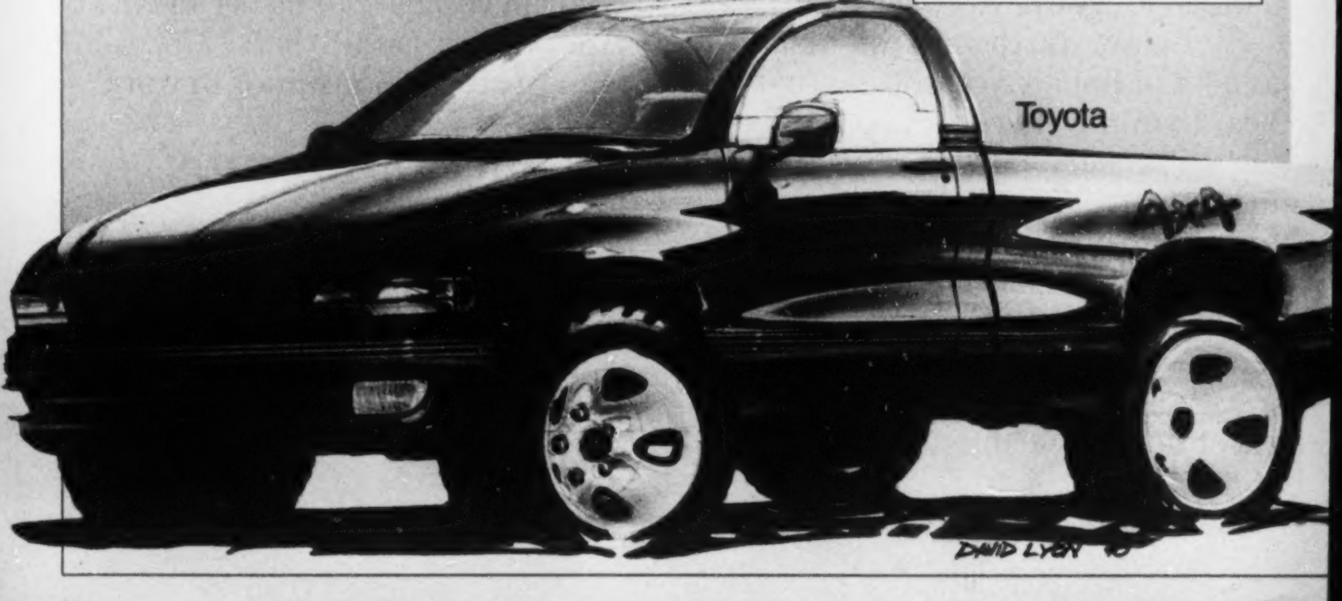
"I'd bet on Toyota," says George Peterson, president of the California firm AutoPacific. "They've had a strong presence in the US pickup market since the '70s, and they dominated the compact pickup market until just recently. They think they understand it."

Thomas O'Grady, chief analyst at Integrated Automotive Resources and publisher of the industry newsletter *Fast Track News*, also sees Toyota as a definite player, debuting with a mid-



Toyota will be the first Japanese truckmaker to upsize – if Isuzu doesn't get there first. The big Toyota depicted here will feature evolutionary styling, V8-competitive power and torque. (David Lyon)

Is this Gobi-inspired Nissan 'dualie' two product cycles away? Nissan says compact Gobi concept truck 'stretched the envelope' in light truck design – and not just for compacts. Gobi may see low-volume production at Smyrna. (David Lyon)



WHAT THE JAPANESE WILL NEED

Requisites for a serious Japanese challenge include:

- 100,000 unit minimum volume, per maker, to sustain investment.
- US assembly capacity. US production of a full-size pickup makes sense for Toyota, either at NUMMI (which gets the compact truck late in '91) or at a 'mini-facility' at Georgetown, KY that could handle the volume.
- Manufacturing and materials advantages that can take out cost. A full-size pickup costs about the same to assemble as a compact, says consultant Jim Harbour of Harbour and Assoc. It's mainly the materials costs that make the bigger truck more expensive. Watch Toyota employ novel manufacturing methods, like its Flexible Press System (May '90 *AI*, p.71), on the big truck, says George Peterson.
- More flex in the assembly lines at Subaru-Isuzu Automotive. If Isuzu wants to build big pickups in the US, this plant -- which now has 72,000 unit truck capacity – may have to be reworked. It's a logical choice for such a project – compact pickup production there is expected to reach 60,000 units a year by late '91, and Kodeo production has just commenced.
- V8-class engine torque. It doesn't have to be a V8 – just pull like one. Four-valve heads are not needed here (and would add cost anyway). But looming CAFE regs will dictate high combustion efficiency. Image is important in what's under the hood – if Toyota's two-stroke six can make the torque of a small-block V8 with better fuel economy, it might woo the faithful. – *LB*

size pickup, then following with a full-size truck by 1995-96.

"We've expected the Japanese to get into that [full-size] market for quite awhile," O'Grady notes. "Everything they've done so far in getting there is very logical. The full-size market is one they can't ignore – it's at least 900,000 to a million units."

The analysts say that any import entry into this market will have to maintain at least a 100,000 unit sales presence to survive. Initially, they'll cause the current market to expand slightly; then they'll start eroding the domestics' market share.

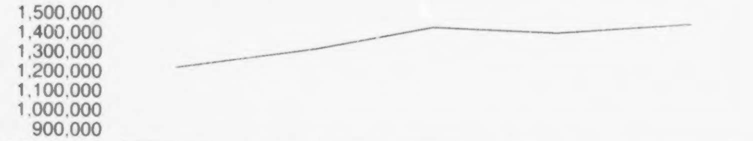
Long dominated by Chevrolet and Ford, the 'big' pickup market has been a white-hot war zone since the '80s, when America 'found' the light truck as personal transport. By decade's end, Ford's F-series had been the nation's best-selling vehicle for eight straight years, and the top-selling full-size pickup for 13 years in a row.

Since then, the Big Three's truck plants have generally worked flat-out to pace demand, which at its 1988 peak totalled over 1.4 million units (see chart). And they've continued to sell amazingly well with heavy incentives and rebates.

Ford, which has yet to give up one unit to GM, is currently capacity-constrained due to AOD (automatic overdrive) transmission availability. But Dearborn by no means has the full-size market to itself. GM has turned up the heat since its C/K series

The Toyota and Nissan renderings are the work of David Lyon, a 1990 graduate of the Center for Creative Studies in Detroit. While completing his degree in Transportation Design at CCS, Lyon worked part-time at the Troy-Pioneer Group Design Center in Madison Heights, MI, participating in the Oldsmobile Expression concept car project.

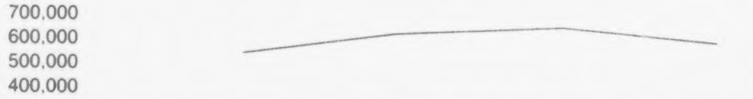
FULL- and MID-SIZE PICKUP SALES 1986-90



	1986	1987	1988	1989	1990 (proj.)[1]
TOTALS	1,236,315	1,280,900	1,416,544	1,377,620	1,390,000
Full-size	1,207,270	1,181,855	1,323,148	1,288,326	1,311,000
Mid-size[2]	29,045	99,045	93,396	89,294	90,000
F-series	544,850	550,125	584,169	566,387	580,000
GM C/K	555,850	534,060	656,966	631,637	640,000
Dodge D/W	106,451	97,670	82,013	90,302	91,000
Dakota	29,045	99,045	93,396	89,294	90,000

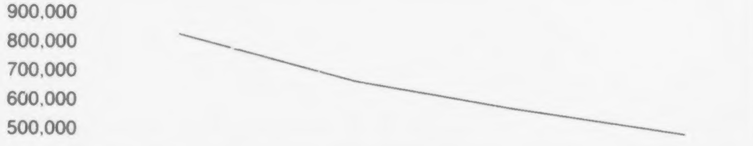
[1] Automotive Industries projection [2] Mid-size: Dodge Dakota

AMERICAN COMPACT PICKUP SALES 1986-90



	1986	1987	1988	1989
TOTALS	552,376	617,387	637,893	590,491
Ford Ranger	269,490	305,295	298,579	284,125
GM S-10/S-15	249,500	273,998	301,343	281,292
Jeep Comanche	33,386	38,094	37,971	25,074

JAPANESE COMPACT PICKUP SALES IN THE US: 1986-90



	1986	1987	1988	1989
TOTALS	851,499	698,118	578,686	519,342
Toyota	320,702	252,935	230,373	208,604
Nissan	214,830	161,614	127,699	132,624
Mazada	157,127	123,699	93,287	78,492
Mitsubishi[1]	107,013	115,573	86,547	52,646
Isuzu	51,827	44,297	40,780	46,976

[1] Includes Dodge D-50

FULL-SIZE PICKUPS

Chevrolet and GMC trucks were introduced in 1988, parrying new Ford options, special packages and marketing thrusts with ones of its own.

At Dodge, sales of their old D/W series pickups are obviously not in the same league, having dropped below 100,000 units in 1987. They're still remarkably steady, and the profits per unit are fat – the tooling was paid for years ago. A replacement, coded T-300, is not due until late 1993.

But Dodge's lack of real success with its mid-size Dakota is what has discouraged other truckmakers from competing in the middle. It's that niche, created by Dakota in 1986, that interests Toyota, says Gil Bamford, Toyota's corporate planning operations manager.

When asked directly about his company's pickup truck plans beyond the compact segment, Bamford is expectedly cagey. He states that mid-size is "the area that is being most carefully evaluated," adding that opportunity is there "to provide more truck" – one with the true three-across seating and column gearshift required in a 'work truck.'

But will Toyota venture into completely uncharted (for them), full-size territory? "We're aware of that market," says Bamford, who spent 18 years with Ford before joining Toyota in 1982. "It's stable and represents a substantially different buyer and product, and therefore a big commitment, in development cost and time. If you're going to do it, you'd better do it with what the customer's looking for."

That's the Japanese auto industry's strongest suit, one they'll need in order to crack the US market's most indigenously American segment. Toyota and the others will have to hit the domestics hard with their proven standbys – product performance and reliability, superb assembly quality and customer satisfaction – and they'll have to enter the market with at least price parity.

"Right now, people are very price-sensitive and are looking for value," maintains Greg Penske, general manager of Longo Toyota in El Monte, CA, the biggest Toyota store in the US. "If Toyota can come in with a 'dualie' (dual rear wheel) or extended cab version that's priced properly, I can sell everything they send us." California leads the US in light truck sales, ahead of Texas.

Penske also believes that years of competing against only themselves has left Ford's F-series and the Chevy/GMC pickups vulnerable in the fit/finish quality area. Analysts O'Grady and Peterson concur. "The Americans realize that they really have to work on that part of their trucks," notes Peterson.

Also in agreement is Roger Simpson, who helped develop the '87 F-series pickup before he became program manager on Ford's new Explorer/Mazda Navajo (UN46) sport utility. Although Simpson says the Japanese are still not as deft as the Americans in marketing light trucks, their standards are more exacting in some crucial quality areas.

"What we haven't yet learned to do," he explains, "is do as many things as concientiously and in a quality fashion, on every step of the vehicle development process." He says Ford Truck is incorporating some Mazda techniques into their product development system. And he reckons that Mazda may be applying Ford ideas, learned from working jointly on UN46, to a full-size pickup project of their own.

To what degree the Japanese pursue this market is still unknown. One thing that is certain is that the product(s) will be excellent in every measurable regard. Yet questions remain: How will a Japanese effort, no matter what the perceived quality or after-sales service, play in Peoria? And what will it take for Toyota and the others to sway bread-and-butter customers like construction companies and tradesmen?

"The Midwest is the only place where there would be resistance," states AutoPacific's Peterson. "It's still the 'bastion of conservatism' in the US. But even if the Japanese gain a foothold in large pickups, it'll take them years to develop a niche in this market."

Can the Lexus/Infiniti passenger car analogy be applied here? Superdealer Penske says yes. Toyota's Bamford isn't so sure. He indicates that Lexus' multi-billion-dollar triumph of offering a lower-cost Mercedes-Benz may have been an easier endeavor for his company than taking on the two American pickup truck icons.

"It's an area that GM and Ford have," admits Bamford, "and they can probably keep having it – as long as they continue to produce good trucks."

SNAKESKIN BOOTS AND ISUZUS

"They're telling us we're about two years away from having a full-size pickup," says Reed Bond, general sales manager at Sam White Isuzu in Houston, Texas.

Bond, a 16-year veteran of new car sales, is understandably excited about Isuzu's news. There are more light trucks sold in Texas than in any other state *sans* California. His dealership is the largest Isuzu store by volume in the US, and the second largest in truck sales.

Bond and another Isuzu dealer report that according to Isuzu, the company already has a 4.1 L aluminum, ohc V8 ready for its Suburban-sized sport utility [bigger than the Rodeo, which replaces the Trooper] due out in late 1991. He's heard fuel economy numbers of around 25 mpg in the 4x4 chassis. And Isuzu is telling dealers it'll handle trailer-towing packages up to 10,000 lb. An all-Isuzu 3.1 L V6 is also due next year.

Of the big pickup, Bond believes Texans "will jump all over it," Japanese or not.

"I think there's a 75,000-100,000 unit market for full-size imported pickups in the US, and it's mostly in the Sunbelt," he notes. "And it'll do well on the West Coast, because people there are more quality-minded. They perceive an import is a better truck, whether it is or not."

Should the company grapevine be correct, Bond is confident Texas truck buyers of all stripes will accept a big Isuzu.

"In Texas, it's a price- and value-minded market," he says. "Isuzu's fleet business is the largest of all the import truckmakers. About 40-45% of my business is either total fleet or someone using the truck for work. These people want value-for-dollar and quality, above all." – ***LB***

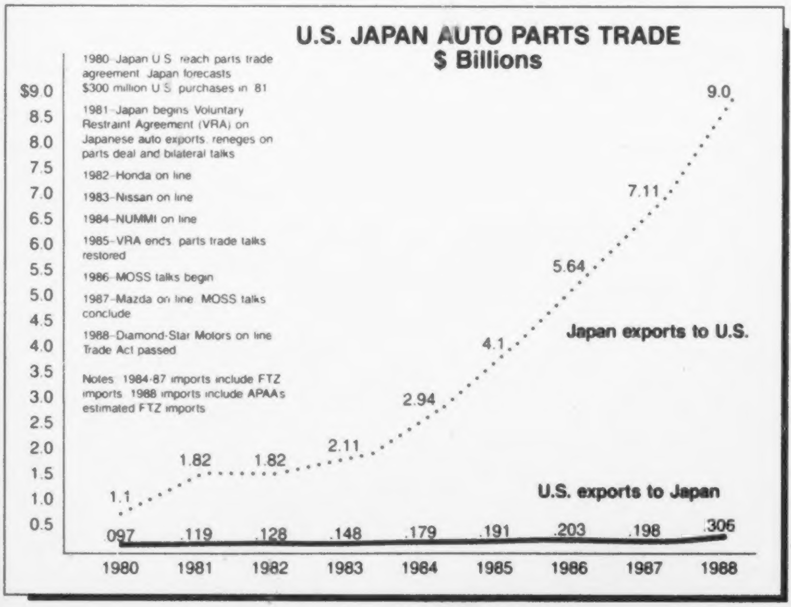
PRESSURE SENSITIVE

Japan avoids the trade blacklist with some armtwisting by MITI. But will American suppliers benefit?

by JOSEPH M. CALLAHAN

An apparent turnaround in purchasing by the 11 Japanese automakers – one that could greatly expand business for American suppliers – may have played a major role in Japan not being listed among the countries targeted for stiff trade retaliation by US trade representative Carla Hills.

This surprising reversal, dubbed the 'April Miracle' by one veteran of the auto trade wars, seemingly has persuaded the Bush Administration not to name Japan as a Super 301 country. Such a listing would have allowed the US to impose retaliatory tariffs as high as 100% of the imported products' cost.


U.S. JAPAN AUTO PARTS TRADE
$ Billions

The Super 301 provision in the 1988 Fair Trade and Auto Parts Act was inserted primarily to help the US reduce its trade gap with Japan, which last year amounted to $49 billion, including over $10 billion worth of automotive parts.

Hills recently told a Senate committee that Japan would not be listed and that the Bush Administration is encouraged by the Japanese progress in opening markets and resolving trade disputes.

Supplier Reaction: Disbelief

These developments in auto parts purchasing occurred last April at a three-day joint meeting of the Motor & Equipment Manufacturers Assn. (MEMA) and the Japanese Automobile Manufacturers Assn. (JAMA) in Las Vegas. The meeting involved 156 Japanese automotive executives, including many from Japan, and about 200 marketing and engineering representatives of 59 US suppliers or their divisions.

Reaction of the American participants ranged from euphoric to almost disbelief. Several suppliers discussed the meeting with *AI*, but some insisted on speaking off-the-record, fearing they might jeopardize future orders.

Even before Hills announced that Japan would not be on the Super 301 list, several suppliers stated that this concerted purchasing approach by all 11 Japanese vehiclemakers was ordered by MITI (Ministry of International Trade and Industry) to prevent Japan being named as a grossly unfair trader.

Strong arguments for placing Japan on that list were made last February at a Commerce Department hearing by the Automotive Parts & Accessories Assn. (APAA), the United Auto Workers, GM's Automotive Components Group, New Venture Gear, the Manufacturers Alliance Through Productivity and Innovation and many other organizations.

Julian C. Morris, APAA president, reported that the Japanese auto parts trade surplus, including parts brought in through Free Trade Zones, had exploded 10-fold, soaring from $1.1 billion in 1980 to $10 billion in 1989 (see chart). During this same period, US auto parts shipments to Japan rose from $7.9 million in 1980 to around $300 million in 1989.

In addition to the $10 billion surplus in auto parts from Japan, US automotive suppliers are also facing stiff competition from some 300 Japanese supplier transplants recently established in the US. Most of these are owned or

Continued on p. 47

partly owned by the Japanese OEMs.

This quiet invasion has driven hundreds of US auto suppliers out of business while producing serious concern among the other OEM and aftermarket suppliers. Morris also estimates that the decline in domestic car sales has also been a big factor, eliminating as many as 175,000 supplier jobs in recent years. The Commerce Department says that 50% of US suppliers sell to both the OEMs and the aftermarket and the other 50% sell only to the aftermarket.

Commenting on the Las Vegas meeting, Dennis Gormley, chairman of MEMA and president of Federal-Mogul Corp., notes that many new business opportunities have been identified. He says that agreements have been reached and are being implemented.

"Today's achievements are the result of persistent efforts on the part of all JAMA member companies to cooperate and seek business with US parts suppliers," states Hiroshi Okuda, cochairman of the MEMA-Jama Liaison Committee and senior managing director of Toyota Motor Corp.

Almost without exception, the automotive suppliers *AI* interviewed say the only thing that has been persistent about the JAMA members has been their rebuffs to US parts suppliers.

A spokesman for the US Commerce Department says significant progress was made by US suppliers at the Las Vegas meeting. He attributes much of the previous failure of US suppliers to sell to the Japanese to the American inability to meet the Japanese standards. He adds that some unidentified US companies had told the Commerce Department that the Japanese requirements were beyond them.

More Pressure Needed

Lee Kadrich, APAA's director of government affairs, says the pressure of Super 301 has helped the supplier group get to this stage. But he explains that it's still early and that sustained pressure is needed to make progress.

Super 301 expired last April 30th. It can only be revived with new legislation.

Possibly the most enthusiastic participant in the Las Vegas meetings was John P. Reilly, president of Tenneco Automotive and chairman of the Automotive Parts Advisory Committee (the Quayle Committee), which advises the Commerce Department on parts-supplier matters.

Reilly, who has been seeking Japanese business for six years, is convinced that the Japanese automakers are sincere in wanting to boost their business with US suppliers. "Those were tremendously successful meetings," he says. "There's a great urgency on the part of the Japanese vehicle companies to place business with domestic suppliers."

A market change has occurred, maintains Reilly. But it is one that will take time to bring fruit. "The theme of the meeting wasn't to hand out purchase orders," he says. "It was to dis-

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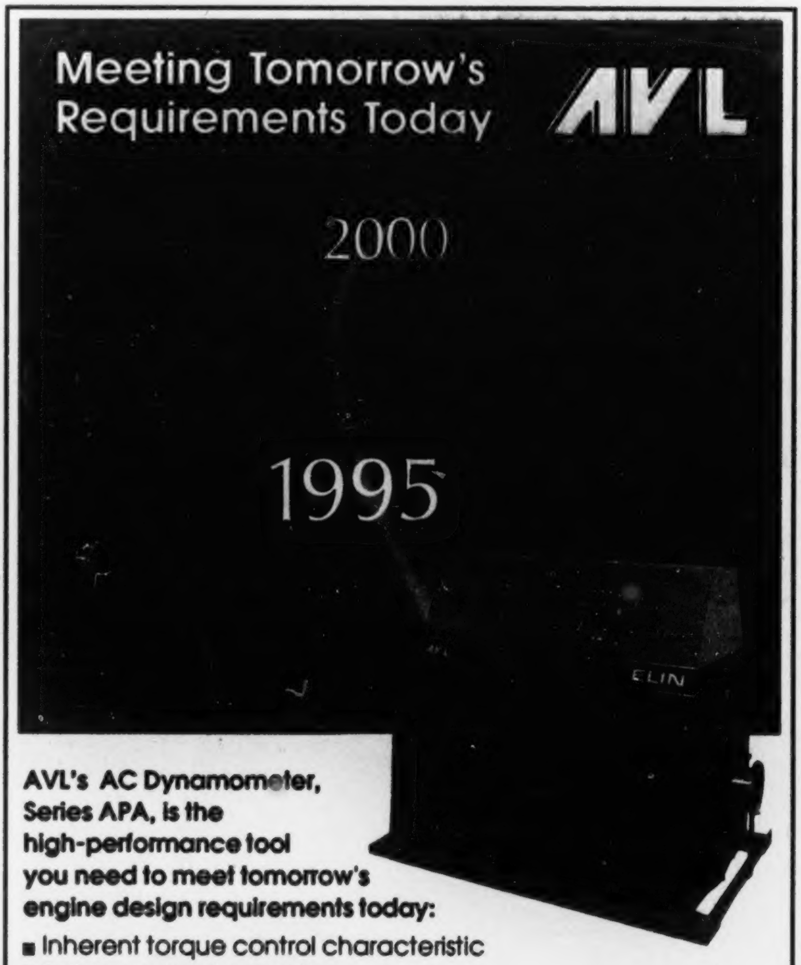

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cuss business opportunities."

Joseph Malus, Rockwell International's VP for business development on light vehicle components, was encouraged by the meetings with the Japanese at Las Vegas. But he cautiously adds that "only time will tell how much good this will do in terms of American companies shipping auto parts to Japan or doing business with the transplants here."

In the past, American suppliers have said there were special ways of dealing with the Japanese if you wanted their business. But now that MITI has applied pressure, Manus notes how quickly and easily his company is able to communicate with them.

Another surprising thing to Manus was that the Japanese were unaware of Rockwell's product line. This lack of familiarity is particularly surprising, since Rockwell has an office in Japan and the company does a relatively small volume of business with the Japanese manufacturers in the US and Japan.

Robert Gualdoni, director of business planning development for Allied Signal, described the series of meetings as "very worthwhile. This meeting gave us an opportunity to meet some of their senior people who we don't encounter during our normal marketing contacts," Gualdoni notes. "I think we'll get some business out of them. I can hardly believe it, but these meetings have got to do something for us in terms of business."

Like many companies, Allied Signal and its subsidiaries have had some business with the Japanese over the years. But the company has been struggling for about 10 years to expand this business to a significant level. This volume took a meaningful upturn in 1985 when Allied acquired Garrett, the turbocharger producers who have a facility in Japan.

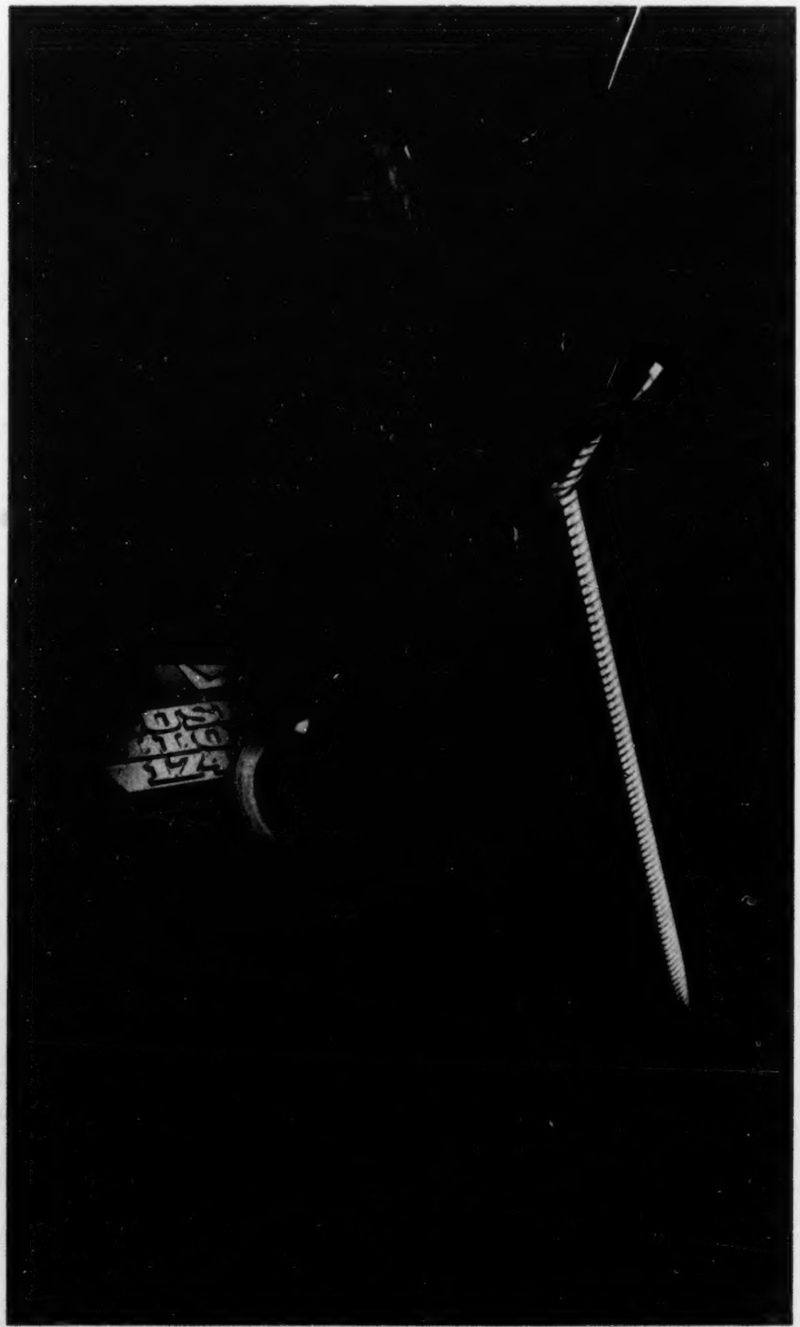
Incidentally, it has been estimated that some 80% of the US parts suppliers have a small or token amount of parts sales to the Japanese OEMs. Although this volume has been generally insignificant in terms of the bottom line, it gives these companies hope that larger sales may be on the horizon.

One of those willing to speak up is David Zimmer, president of New Process Gear, the new Chrysler-General Motors joint venture. He's also a member of the Quayle Committee.

Cartel A Barrier

As an employee of Chrysler Corp. and Ford Motor Co. before that, David Zimmer has been knocking on the doors of the Japanese OEMs for about 15 years, with only minimal success.

The major question now for the Japanese OEMs and the American parts suppliers is this: In view of Keiretsu and the big investments the Japanese have made in their US transplants, who's going to lose the business that apparently has been promised to American automotive suppliers? AI



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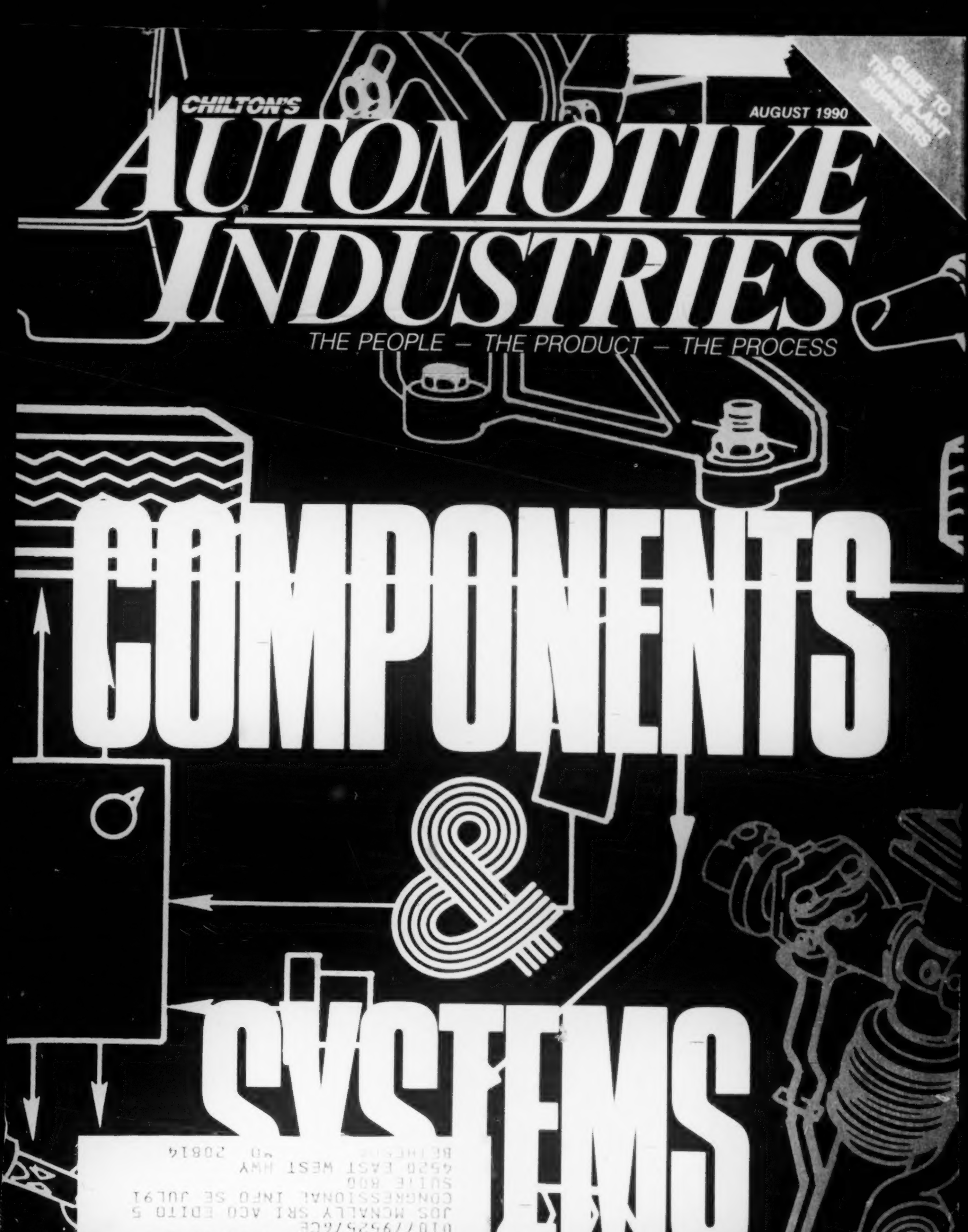

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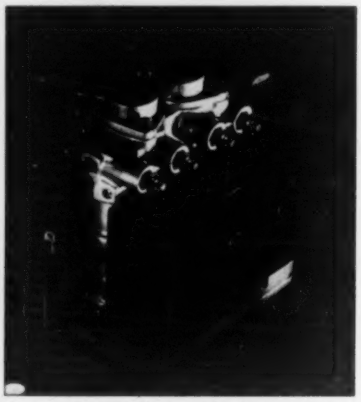

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Are Your Pensions Safe?

JOE CALLAHAN is editor-at-large of Automotive Industries magazine

Forty percent of the nation's most underfunded pension plans are in the automotive industry.

The automotive industry is the biggest pension underfunding concern today for the Pension Benefit Guaranty Corp. (PBGC), the federal agency that insures the pensions of 40 million American workers covered by 103,000 defined pension plans. Those plans are largely based on income and time in service.

PBGC and the whole Bush Administration are nervous about the gigantic government-backed insurance program for fear it could become another S & L financial debacle. Chances of such a pension fund disaster appear to be quite slim, although a recession or even a Wall Street collapse could produce big problems.

Even though Chrysler Corp., General Motors and 18 suppliers have 20 of the nation's 50 most underfunded plans, it's also quite certain that the pensions of the employees of these companies are safe, as are the pensions of all employees insured by the PBGC.

While participation in the PBGC's insurance program is voluntary, this 16-year-old government agency has recently taken several steps to persuade its client companies to fully fund their pension plans as soon as possible.

Most prominent of these moves was the publication earlier this year of a list of the nation's 50 most underfunded pension plans.

This will now be done annually. Although underfunding a pension plan is neither a crime nor a signal of looming disaster, the Guaranty Corp. wants its clients to fund their pension coffers as well as possible, because it could incur huge future liabilities should any of these firms fail.

Currently the PBGC is paying the pensions of 109,000 US workers and expects to pay the pensions of 132,000 more as they reach retirement age. The agency claims it will "pretty well" cover every retiree's full pension up to a maximum of $2164 a month. Medical insurance and other fringe benefits are not covered.

The premium for this pension insurance is $16 per person per year, although it can climb to $50 per year, depending on how much the pension plan is underfunded.

James B. Lockhart, PBGC's executive director, emphasized recently that the firm's inclusion on the underfunded list is not an indication of a company's poor financial health or failure to satisfy the laws.

However, he added, "Workers are best assured of receiving their full pensions if employers fully fund their plans."

He also said that pension benefits are generally well protected by both the government insurance and the conservative investments which most companies have to increase their pension assets.

When a PBGC spokesperson was asked how well the pensions of today's employees are protected, she said, "They're very well protected in general. There is over $1 trillion in the pension funds today to cover some $800 billion in defined pension plan obligations."

While [illegible] automotive pension plans are underfunded, many other industries and companies often overfund their plans because of very successful investments or their desire to prepare for cyclical downturns or for tax advantages.

But for a variety of reasons, many automotive firms tend to underfund their plans. The 20 automotive companies listed below are underfunded a total of $8.3 billion, which is 59% of the $14 billion underfunding of the 50 most underfunded plans, and 27.6% of the total $30 billion that all PBGC-guaranteed pension plans are underfunded.

Chrysler Corp. alone has a pension fund deficit of $2.628 billion, which is 8.7% of the nation's $30 billion total pension underfunding.

A Chrysler spokesman said this was in line with Chrysler's "conservative" pension funding program which was announced two years ago to reduce its formerly greater pension fund indebtedness. This amounted to $3.05 billion in 1988.

Although these are substantial sums, Chrysler now has 62.4% of its pension program funded, which is a greater funding ratio than five other automotive pension funds. Sharon Steel has the most depleted pension fund with only 31.2% of its pension obligations covered.

General Motors was also listed because its pension fund had a shortfall of $1.9 billion last year. But this was only 9.9% below its fully funded level.

GM made no contributions last year to its major pension funds. Incidentally pensions of early retirees are treated the same as those of regular retirees.

At the end of 1989, Ford Motor Co.'s salaried pension plan was overfunded by $3.028 billion, while its hourly plan was underfunded by $349 million, resulting in an overfunding of $2.679 billion.

Both hourly and salaried defined pension plans are insured by the PBGC, with the salaried plans generally being contributory in part.

Many companies have other non-defined pension plans for top executives and other individuals. These are based on other factors than years in service and income.

20 MOST UNDERFUNDED AUTOMOTIVE PENSION PLANS

(IN MILLIONS)

COMPANY	BENEFITS GUARANTEED	PLAN ASSETS	PERCENT FUNDED
Sharon Steel	$ 247	$ 77	31.2
LTV Corp.	381	138	36.1
Uniroyal-Goodrich	763	370	48.4
Eaton Corp.	120	68	56.5
Borg-Warner	181	107	59.0
Chrysler Corp.	6,987	4,358	62.4
Bethlehem Steel	4,192	2,812	67.1
Tenneco Inc.	296	200	67.6
Reynolds Aluminum	771	523	67.9
United Technologies	309	215	69.8
Dana Corp.	496	355	71.4
Rockwell Int.	621	446	71.8
Allegheny Ludlum	342	263	76.8
Navistar Int.	2,205	1,751	79.4
Armco Inc.	1,912	1,589	83.1
National Steel	896	753	84.0
Honewell Inc.	367	310	84.7
Goodrich	409	353	86.4
Goodyear	966	865	89.6
General Motors Corp.	19,388	17,478	90.1

TRANSPLANT SUPPLIER DIRECTORY

290 Japanese automotive suppliers are now in the US. Here's who they are, where they are, and what they do.

by JOSEPH M. CALLAHAN

In the past 24-26 months, 58 additional Japanese automotive supplier plants have been established in the US, bringing the total of these plants to 290. Some of the new plants represent new companies, while others are subsidiaries of existing companies.

None of the new plants were included in *Automotive Industries*' compilation of February, 1989, which listed 232 Japanese supplier plants doing business in the US. Most of the new plants have been established since 1988, although a number started up earlier.

The following list of new Japanese facilities in the US was compiled by ELM International of East Lansing, MI, a firm that specializes in tracking foreign suppliers of North American industries.

Last year's *AI* list of Japanese suppliers was supplied by the Japanese government to the US Department of Commerce. But the Japanese government no longer supplies such a list. Consequently, the Commerce Department, which is supposed to keep track of what's happening to the US auto supply industry, doesn't even know the extent to which the Japanese are moving into this country.

The Motor and Equipment Manufacturers Assn. (MEMA), a major auto supplier trade organization, also was unable to provide data on the transplant supplier invasion for the public. It was suggested that this information had commercial value.

While the phrase "Parent" in the following list normally would denote the owner of a plant, the term in most cases means "Brother," since the Japanese and their joint-venture partners generally are shy about revealing the real ownership.

A wide range of automotive parts and components are now being produced at these plants, only excluding bodies, engines and transmissions but including even keys. They will largely supply parts, many of whose elements are imported, to the Japanese vehicle transplants. But economic forces are causing the US vehicle makers to increasingly patronize these suppliers. AI

New Japanese Auto Supplier Plants In The US

PLANT	LOCATION	PARENT	PRODUCTS	EMPLOYEES	START
Ahresty Wilmington Corp.	Wilmington, OH 45177	Ahresty Wilmington Corp.	Aluminum castings	100	1988
Allied Ring Corp.	Manchester, MO 63011	Allied Ring Corp.	Steel piston rings	12	N/A
American MSC	Troy, MI 48083	American MSC	Precision compression rings	15	1987
Asahi Motor Wheel Corp.	Somerset, KY 42501	Asahi Motor Wheel Corp.	Aluminum wheels	300	1988
Automotive Electronic Control Systems	Anderson, SC 29622	Automotive Electronic Control Systems	Electronic controls	N/A	1988
CEI Company	Springfield, TN 37173	CEI Company	Motor actuators	90	1989
Clevite-Bridgestone	Angola, IN 46703	Clevite-Bridgestone	Rubber parts	180	N/A
CME Corp.	Mt. Pleasant, MI 48858	CME Corp.	DC Motors for wipers, windows	165	1987
D and A Technology	Mt. Pleasant, MI 48474	D and A Technology	Encapsulation of glass	N/A	1989

PLANT	LOCATION	PARENT	PRODUCTS	EMPLOYEES	START
Dexter Fastener Technologies	East Dexter, MI 48130	Dexter Fastener Technologies	Auto fasteners	N/A	1989
Diamet Corp.	Columbus, IN 47202	Diamet Corp.	Engine, transmission parts	85	1988
Elsa Corp.	Elwood, IN 46036	Elsa Corp.	Exhaust systems, fuel tanks	11	1987
Enpak Inc.	Memphis, TN 38114	Enpak Inc.	Auto batteries	175	1988
Freudenberg-NOK Partnership	LaGrange, GA 30240	Freudenberg-NOK Partnership	Various oil seals	833	1989
Goetze Corp. of America	Manitowoc, WI 54221	Goetze Corp. of America	Piston rings	284	N/A
Goetze Corp. of America	Schofield, WI 54476	Goetze Corp. of America	Valve inserts, piston rings	250	N/A
Goetze Gasket Co.	LaGrange, GA 30240	Goetze Corp. of America	Gaskets, spacers, rings	160	N/A
Green Tokai Co.	Brookville, OH 45308	Green Tokai Co.	Door, window seals	160	1987
Greenville Technology, Inc.	Greenville, OH 45331	Greenville Technology, Inc.	Trim, wheel covers, other parts	232	1987
H.A. Parts of Indiana	Greencastle, IN 46135	Happico Inc.	Wheel covers, trim	150	1988
Harada Industries of America	Gardena, CA 90248	Harada Industries of America	Radio antennas	120	1977
Hi-Lex Controls	Litchfield, MI 49252	Hi-Lex Corp.	Window regulators	125	1975
Hitachi Cable Indiana	Albany, IN 47150	Hitachi Cable Indiana	Various hose assemblies	20	1987
Hoover-Ikeda	Murfreesboro, TN 37130	Hoover-Ikeda	Trim, headliners	13	1987
Ichikoh Mfg. Inc.	Shelbyville, KY 40065	Ichikoh Mfg. Inc.	Auto mirrors	180	1987
Il Stanley Co.	Battle Creek, MI 49015	Il Stanley Co.	Lights, modular components	370	1987
Indiana Precision Technology, Inc.	Greenfield, IN 46140	Indiana Precision Technology, Inc.	Fuel injectors	200	1988
Intat Precision	Rushville, IN 46173	Intat Precision	Engine, differential parts	20	1988
ITW-Nifco, Inc.	Hilliard, OH	ITW-Nifco, Inc.	Plastic fasteners,, other parts	59	1987
Kamco Industries	West Unity, OH 43570	Kamco Industries	Small plastic parts	40	1987
Koyo Corp.	Battle Creek, MI 49015	Koyo Corp.	Air conditioner tubing	42	N/A
Lucas Sumitomo Brakes, Inc.	Lebanon, OH 45036	Lucas Sumitomo Brakes, Inc.	Front brake calipers	90	1988
M-Tek Inc.	Manchester, TN 37355	M-Tek Inc.	Soft door trim	100	1987
MCC Panasonic	Peachtree, GA 30269	MCC Panasonic	Radio components	680	1987

Continued on p. 62

TRANSPLANT SUPPLIER DIRECTORY

PLANT	LOCATION	PARENT	PRODUCTS	EMPLOYEES	START
MG International	Powder Springs, GA 30338	MG International	Wire harnesses	36	1987
Michigan Automotive Compressor, Inc.	Parma, MI 49269	Michigan Automotive Compressor, Inc.	Air conditioner, clutch parts	250	1989
Murata Erie North America	State College, PA 16801	Murata Erie North America	Ceramic resonators, filters	750	1981
Nachi Precision Industries, Inc.	Greenwood, TN 46143	Nachi Technology Industries, Inc.	Ball bearings, gear cutters	N/A	N/A
Nachi Technology	Greenwood, TN 46143	Nachi Technology	Ball bearings	N/A	N/A
Nakanishi Mfg.	Wintersville, GA 30683	Nakanishi Metal Works Co.	Bearing retainers	80	1988
Nakatan Horizon Industries, Inc.	New Boston, MI 48916	Nakatan Horizon Industries, Inc.	Transmission, clutch components	7	1988
New Mather Metals	Toledo, OH 43612	New Mather Metals	Suspension, clutch components	117	1987
Newman Technology	Mansfield, OH 44902	Newman Technology	Exhaust, window, molding parts	355	1987
Nippondenso Tennessee, Inc.	Marysville, TN 37602	Nippondenso Tennessee, Inc.	Instrument cluters	120	1988
Ohio Star Forge	Warren, OH 44483	Ohio Star Forge	Forged bearings	12	1988
Ortech	Kirksville, MO 63501	Ortech	Door locks, handles, keys	11	1987
PK U.S.A.	Shelbyville, IN 46178	PK U.S.A.	Parts for suspensions, trim, chassis	150	1988
Purodenso Co.	Jackson, TN 38302	Purodenso Co.	Filters, filter housings, elements	15	1990
Quality Spring/ Togo Inc.	Coldwater, MI 49036	Quality Spring/ Togo Inc.	Various springs	150	1987
Setex Inc.	St. Marys, OH 45885	Setex Inc.	Car seats	130	1988
Shiroki-Wickes	Smithville, TN 37166	Shiroki-Wickes	Electro-mechanical assemblies	120	1988
Sparta Foundry	Sparta, MI 49345	Goetze Corp. of America	Piston rings, valve guides, pulleys	300	N/A
T.S. Trim Industries	Athens, OH 45701	T.S. Trim Industries	Interior fabric panels	286	1987
Takata-Fisher Corp.	Pigua, OH 45356	Takata-Fisher Corp.	Seat belts	110	1984
Trim Masters	Harrodsburg, KY 40330	Trim Masters	Seat covers, door trim	420	1987
Vuteq Corp.	Bloomington, IL 61761	Vuteq Corp.	Auto windows	10	1987
Yotec, Inc.	Springfield, OH 45503	Yotec, Inc.	Steering parts, water pumps	65	1988
Zua Autoparts	Oakwood, GA 30566	Zua Autoparts	Power steering pumps	20	1989

AUTOMAKER QUARTERLY REPORT

by DR. THOMAS O'GRADY

The downturn in automotive sales continued through the second quarter of 1990, with total volume coming in at more than 8% below 1989 levels. Cutbacks in both car and light truck production also continued throughout the quarter, although the reductions were not nearly as severe as in the first three months of the year. Recent third and fourth quarter production schedules still appear too optimistic, and we expect US automakers to trim additional output from their planned levels.

Midsummer price increases from the domestics, combined with high expected price hikes across the board for the 1991 model year, dim the outlook for a sales rebound in the second half of the year.

During the first quarter of this year, GM appeared to be off to a very good start in its efforts to reverse its downward slide in market share. However, by the end of the second quarter, GM's leading margin narrowed considerably. As expected, Ford lost about one and one-half of a percentage point in market share during the quarter. Chrysler's share of the car market slipped from 10.7% in 1989 to 8.9% in 1990, allowing Honda to surpass it in number of passenger cars sold.

> *Chrysler's share slipped from 10.7% in 1989 to 8.9% in 1990, allowing Honda to surpass in number of passenger cars sold.*

Once again, Honda's Accord topped the best seller list for the quarter, but this time its sales lead over the Ford Taurus and the Chevrolet Corsica/Beretta widened to more than 26,000 units. The Honda Civic also moved up the list to the number four slot, joining two Toyota models (the Camry and Corolla) already in the top ten. However, this is not to say that importers are weathering the industry downturn any better than the domestics. A few foreign automakers – including Honda, Toyota, Mercedes-Benz and Volkswagen/Audi – did increase their respective sales this year, but most of the importers are still struggling not to lose volume. One notable exception is Mitsubishi, which is in the midst of an aggressive expansion in the US and reported a 69.4% rise in its second quarter car sales. AI

Dr. Thomas O'Grady is president and chief analyst of Integrated Automotive Resources in Wayne, PA, and publisher of Fast Track News.

WHAT'S HOT! Domestic Auto Sales 2nd Quarter 1990

Carline	'90	'89	% Change
Accord*	108,973	94,127	15.77%
Taurus	82,635	102,165	-19.12%
Corsica/ Beretta	82,229	112,461	-26.88%
Civic/ CRX*	81,012	68,019	19.10%
Escort	75,502	86,464	-12.68%
Cavalier	74,223	81,794	-9.26%
Camry*	71,489	75,622	-5.47%
Grand Am	68,067	56,404	20.68%
Lumina**	62,790	22,149	183.49%
Corolla*	59,555	50,120	18.82%

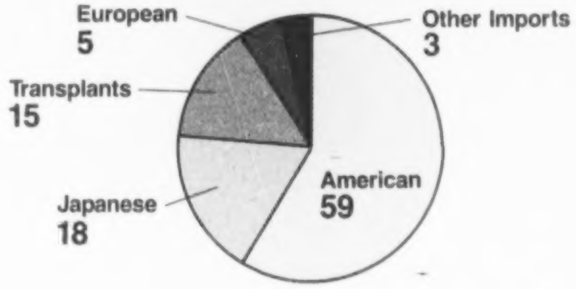
* – Includes imports

** – Lumina replaced the Chevrolet Celebrity, which sold 55,192 units in the second quarter of 1989

US Passenger Car Market Shares 2nd Quarter, 1990

Manufacturer	'90 Sales	% Total	'89 Sales	% Total	% Change
General Motors	925,497	36.58%	1,006,923	36.55%	-8.09%
Ford	519,009	20.52%	611,724	22.20%	-15.16%
Honda/Acura	243,922	9.04%	216,472	7.86%	12.68%
Chrysler	224,251	8.86%	294,770	10.70%	-23.92%
Toyota/Lexus	202,095	7.99%	176,509	6.41%	14.50%
Nissan/Infiniti	115,232	4.55%	135,865	4.93%	-15.19%
Mazda	58,049	2.29%	58,986	2.14%	-1.59%
Mitsubishi	46,395	1.83%	27,383	0.99%	69.43%
VW/Audi	45,440	1.80%	45,326	1.65%	0.25%
Hyundai	35,462	1.40%	48,599	1.76%	-27.03%
TOTAL CARS	2,529,891	100%	2,755,221	100%	-8.18%

PASSENGER CAR MARKET SHARE BY GEOGRAPHIC BASE



Second Quarter 1990

Passenger Car Market Share By Geographic Base

First Quarter 1990

Manufacturers	Total Sales	Total Market Share
American	1,487,546	58.80%
Japanese	464,231	18.35%
European	123,612	4.89%
Transplants	384,991	15.22%
Other Imports	69,511	2.75%
Total	2,529,891	100.00%

2ND QUARTER 1990 DOMESTIC LIGHT TRUCK PRODUCTION*

COMPANY	FULL-SIZE TRUCKS	COMPACT TRUCKS	FULL-SIZE VANS	COMPACT VANS	FULL-SIZE SPORTS UTILITY	COMPACT SPORTS UTILITY	TOTAL 1Q '90	1Q '89
FORD	170,141	78,347	58,879	62,028	14,647	66,853	450,095	468,750
CHEVROLET	128,422'	55,948	39,321	62,030	31,817	49,058	366,596	372,297
GMC	53,008'	13,541	14,492	14,634	17,631	11,066	124,372	119,991
CHRYSLER/ DODGE	30,604	20,328	26,968	133,963	---	---	211,863	218,935
JEEP	---	2,240	---	---	2,470	66,064	70,774	100,433
NISSAN	---	40,282	---	---	---	---	40,282	30,265
OLDS	---	---	---	11,450	---	---	11,450	---
PONTIAC	---	---	---	13,465	---	---	13,465	---
ISUZU	---	4,512	---	---	---	826	5,338	---

'Includes Suburban and P-model. *Built in the US and Canada.

Boomermobiles

RAY WINDECKER's 45 years in the industry culminated at Ford, where he was research and analysis manager, public affairs. He now runs American Autodatum, an 'automotive numbers and words' company.

> *The children of 'boomers' bought five times as many Ford Escorts as they did Honda Civics.*

Baby boomers, that sometimes mythical, sometimes real, high buying-power group of American consumers aged 26 to 44, buy a great number of cars. In 1989, they purchased 4.34 million new cars for a 44% share of the new-car market.

'Boomers' are people born between 1946 and 1964, children of the post-World War II economic and baby booms. They're not to be confused with yuppies, though. Yuppies conform to a set of physical and mental images generally outlined by the words "I want," while boomers are all people included in that particular age group.

Boomers are everywhere. There are more than 75 million of them and they're courted by all marketers, including those at the auto companies. And why not? Boomers, through sheer numbers, command marketing attention and clout.

In 1975, when many boomers were still too young to drive and their upper age limit was 29 years, the age group as a whole bought 31% of all new cars. By 1980, they held 40% of the new-car market. In 1985, when the boomers' age bulge ranged from 21 to 39 years, they were all of buying age and had reached what is assumed to be the peak of their purchase rate at 45% of all new cars.

In 1989, with the boomer age range then from 25 to 43, their share of new-car purchases was 44%. This is no different statistically than from 1985, indicating the boomers purchasing power peaked in the mid-'80s. That is as it should be, as boomers are a new aging group with no new first-time buyers moving into the market.

Boomers inhabit all of the many levels of social and economic strata. Although they contain a small minority of high-income yuppies, there are a great many more in the moderate income group. Most are average people that react to the market as do other age groups.

One notable trend is that boomers, as they age, buy larger and or more expensive cars. The logic is impeccable – on average, age equates to increased job experience, and therefore more income. Thus, this means both more money to spend with often larger family groups.

A quick look at the segment movement over the past five years shows that boomers bought 59% of the small subcompact cars sold in 1984 but by 1989, that rate had dropped to 52%. Conversely, the boomers bought 26% of the luxury cars delivered in 1984 and 31% in 1989. Obviously, there was more money available to the aging boomers and more offspring requiring transportation.

The shift in boomer buying patterns were almost, but not quite, a direct movement towards the larger or more expensive cars. The exception was the large-car segment dominated by the likes of the Chevrolet Caprice and Ford Crown Victoria where the buying rate was steady, as was the styling of the cars. It will be interesting to see if the new, high-styled Caprice and the upcoming Crown Victoria will attract boomer buyers.

Boomers will continue as an important part of the automotive market. In the year 2000, they will be of prime buying age, ranging from 36 years to 54. Even 20 years from now, in 2010, the oldest boomers will be 64 – the youngest 46 – and they should then still make up more than 35% of all new car buyers.

Following national trends, the boomers in 1989 bought Honda Accords and Ford Taurus models. Boomers do present a challenge to the domestic carmakers. To win a larger share of the boomer market, the domestics must convince many of the boomers – raised in an anti-establishment time – that the establishment has changed.

However, note that the boomers' children, now ranging in age up to 24 years and attracted by the lower price and acceptable quality of today's domestic cars, bought five times as many Ford Escorts as they did Honda Civics. It will be interesting to watch this post-boomer group as they mature.

Boomer Buys

Category	Percent bought 1984	1989
Subcompact	59%	52%
Small Sporty	71%	66%
Compact	48%	49%
Midsize	31%	34%
Mid Specialty	44%	48%
Large	16%	16%
Luxury	26%	31%